5-2019

Understanding Requirement Generation: Studies on Interventions and Comparison between Novices and Practitioners

Maria Vittoria Elena
Clemson University, mavi4.96@gmail.com

UNDERSTANDING REQUIREMENT GENERATION: STUDIES ON INTERVENTIONS AND COMPARISON BETWEEN NOVICES AND PRACTITIONERS

A Thesis
Presented to
the Graduate School of
Clemson University

In Partial Fulfillment
of the Requirements for the Degree
Master of Science
Mechanical Engineering

---

by
Maria Vittoria Elena
May 2019

Accepted by:
Joshua D. Summers, Committee Co-Chair
Gregory Mocko, Co-Chair
Nathan McNeese

ABSTRACT

Requirements are at the heart of the engineering design process as they define the problem and validate the solution. Requirement definition as an activity has not been well investigated, especially with respect to how to teach this to novice engineers. This study explores the influence that an intervention has on novice engineers in generating requirements for a design problem. An experiment was performed in a fourth-year mechanical engineering design course by giving the participants a design problem for which they had to generate a list of requirements. A lecture on requirements was delivered and then the students were given a second problem. The two problems were tested for similarity in design and in outcome. The data was analyzed using modifications to the ideation metrics of quantity, quality, variety, and novelty. Quantity addresses the number of requirements generated and the results indicate a statistically significant positive influence by the intervention ($p = 4.76E-14$). Completeness evaluates the grammar of the requirement by identifying whether it has a subject, verb, or modal. It is found that the intervention had little influence on the completion. Variety is assessed using eighteen categories to classify each requirement. More categories were addressed after the lecture than before. Novelty is evaluated on the level of uniqueness of the requirement against the complete set generated, based on both syntax and semantic filtering. No novel requirements were found in the "before" treatment but were found in the "after" treatment.

A brief initial experiment comparing novice to practitioners (as defined by engineering employment for at least 3 continuous years) is done. Findings from this second experiment suggest that practitioners and novices without training performed similarly (p

= 0.71), and that novices with training performed better than the practitioners ($p = 0.0014$) with respect to quantity (Count 3). This could serve as a reason for academia to equate the performance of experiments with students without significant training to practitioners.

DEDICATION

This thesis is dedicated to my parents, Stefania Del Papa and Dario Elena, for supporting me through my school career and unexpected life decisions, for always being by my side no matter the distance and giving me unconditional love and support. I would also like to dedicate this thesis to my step dad Giuseppe Lupattelli, *per avermi accolto a braccia aperte come una figlia*, and my brother Davide and sister Caterina for always being there for me and making me smile in ways no one else can. This dedication also goes to my partner and soulmate, Tobias Hildmann, for sticking by me through the good and the bad and lifting me up in times of need.

This thesis is also dedicated to my grandparents. *Nonna Franca Maspes e Nonno Mario Elena grazie per avermi insegnato cosa vuol dire amare ed essere sempre buoni e gentili con il prossimo. Sono convinta che mi guardate e proteggete da lassu'. RIP. Vorrei anche dedicare questa tesi ai miei nonni Fiorella Olivi e Roberto Del Papa. Grazie per avermi cresciuto come una figlia piu' che una nipote. La persona che sono divenuta oggi è anche grazie al vostro supporto ed impegno. Grazie per il vostro amore incondizionato. Nonno Roberto, se oggi sono un ingeniere è perche' ho voluto seguire i tuoi passi. Spero di averti reso fiero. Sei il mio eroe e punto di riferimento.*

ACKNOWLEDGEMENTS

First, I would like to thank Dr. Joshua Summers for accepting me as his student. I still remember the first day we met and immediately knowing that he was the right advisor for me. I was very nervous and excited at the same time. He is not only my advisor, but a mentor and someone I will always look up to. I have grown so much thanks to his support and guidance, coffee breaks and long walks included. In only two years I have become the person I am today thanks to him. Thank you, Dr. Summers, for teaching me how to be a better researcher and engineer. Thank you for all your feedback and the long advising sessions. Thank you for your patience and correcting all my doubts. Thank you for teaching me to be confident and take ownership. I highly and strongly recommend Dr. Summers as an advisor.

I would also like to thank Dr. Mocko for his care and guidance. I first met Dr. Mocko while advising 4020. Since then we have shared thoughts and ideas on design topics that really interested me. He always brought up eye-opening and challenging perspectives that inspired me to think outside the box. Thank you, Dr. Mocko, for all your help, life advice, and support. I also want to acknowledge Dr. McNeese for being a role model. I knew I wanted him to be a member of my committee the moment I stepped into his class. He helped me improve my research skills in his teamwork class by performing extensive literature reviews and reading conference and journal papers. Thank you for agreeing to be part of my committee and investing the time in meetings and reviewing my thesis.

Last but not least, I would like to thank Chase Wentzky, because I never would have made it through without his true friendship, care and moral support. Thank you for a friendship that I am sure will last a lifetime. I would also like to thank all members of the CEDAR Lab with a special thanks to the following individuals that have made my experience unforgettable in both research and social life. These are Apurva Patel, Vijay Sarthy, Nafiseh Masoudi, Nicholas Spivey, Nicole Zero, Shubhamkar Kaulkarni, James Righter, Priyanka Bhovad, Caroline Buck, Sindora Baddam, and Sumana Peddada. Thank you for all your help and encouragement, and all moments shared. I wish you all the best in your future professional and private life endeavors.

TABLE OF CONTENTS

Page

LIST OF TABLES

Table Page

LIST OF FIGURES

Figure Page

Chapter One
MOTIVATION TO STUDY ENGINEERING REQUIREMENTS

In engineering design, generating ideas is a key element to creating a product or solving a problem [1–4]. This is generally accomplished by following a systematic engineering design process [1–4]. The process typically includes four steps: problem definition, conceptual design, embodiment design, and detailed design [1–4]. Often, the success of the solution or product is determined by how well the problem statement is defined [1–4]. To this end, the design problem is expanded into a list of requirements [3]. Therefore, generating requirements is a critical component in the engineering design process because it can determine the success or failure of the final product [1–4].

While researchers have focused their efforts on delineating how to teach engineering design [5–12] and the methodology to teach engineering requirements [13,14], lecture interventions on students remains unexplored. Further, researchers have investigated the impact of using different ideation methods on the quantity, quality, variety, and novelty of the generated solutions [15]. However, the influence that these metrics have on a list of requirements has not been fully explored. Thus, this thesis explores the impact of lecture intervention on the quantity, completeness (quality), variety, and novelty of requirements generated by the students based on a given design problem. Thus, this thesis strives to answer the following questions:

RQ1. How does lecture intervention impact the *quantity* of the requirements generated?

RQ2. How does lecture intervention impact the *completeness* of the requirements generated?

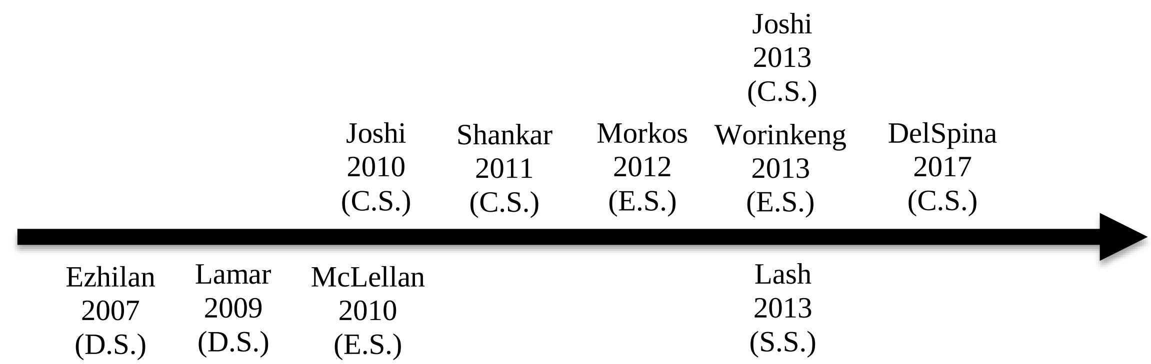
RQ3. How does lecture intervention impact the *variety* of the requirements generated?

RQ4. How does lecture intervention impact the *novelty* of the requirements generated?

To answer these questions, a controlled experiment was performed in a fourth-year mechanical engineering design methods class at Clemson University. The experiment requires two design prompts to be used before the intervention and after. Thus, two equivalent prompts are needed. This will be discussed in section 3.3. A second study is done with the design prompt using practitioners with greater than three years of continuous engineering experience. This study compares these "experts" to the students to explore how differently these populations generate engineering requirements.

1.1 Previous Studies on Engineering Requirements

This research builds upon several years of study of engineering requirements through the CEDAR group. Figure 1.1 shows a timeline and type of studies conducted on engineering requirements in the CEDAR Lab.



*E.S. = Experimental Study, C.S. = Case Study, D.S. = Demonstration Study, S.S. = Simulation Study

Figure 1.1. CEDAR Requirements Studies Timeline

The first work performed with requirements in CEDAR (see Figure 1.1) focused on developing a systematic method for representing mass as a function of requirements and generating solutions that reduce the system's mass [16]. This is achieved by using propagation and mapping requirements to single components to determine their relationship strength by using matrices. This is outlined as a seven-step process that starts with a list of requirements and ends with test matrices that validate the solutions generated to reduce mass. This approach was not experimentally validated, but was demonstrated through different examples [17,18].

The next work develops a formalized syntax to express requirements [19]. The method outlined in the study uses four characteristics (artifact, necessity, function, and condition) to develop a formalized linguistic approach when developing a list of requirements. By using the method proposed, functional and non-functional requirements, as well as the level of specificity and number of incomplete requirements, can be determined. This study is beneficial in understanding how to express and document engineering requirements [20].

A requirement study addresses the impact that level of detail of the design prompt and list of requirements has on the final product [21]. More specifically, a case study is conducted by mapping problem definition to solutions generated. Results from this study show that the more requirements are met, the more detailed solutions are generated. Further, a low to medium level solution is caused by a low detailed problem statement and requirements. The sooner requirements are generated within the design process, the better the final solution will be [22].

In the same year, the earlier method of requirements in relation to mass reduction [16] is revisited by identifying the requirements that impact the system's mass [23]. This is achieved by using syntax and pre-processing rules that observe the requirement's grammar. The requirements are then linked to components based on their relationship which is determined by the amount of affected mass and coupling level of each requirement [24,25].

In the next two years, the requirement focus shifts to requirement change propagation [26,27]. A method is developed to decrease change that propagates in engineering, mainly caused by requirements [27]. Findings suggest that non-functional requirements cause design changes and that the information should be captured in the conceptual stage of design to better identify changes at later stages (detailed and embodiment design) [28]. A tool was created to predict requirement change [26]. This tool is used to analyze how a requirement affects other requirements generated. The relationship between requirements was established using syntax. This provides the engineer with a tool to effectively forecast that the changes made do not have a negative impact on other requirements within the overall list of requirements [29,30].

Another study published in the following year investigates the role of engineering requirements in idea generation [31]. This was accomplished through three phases. The first phase was conducted using surveys and interviews to understand how engineering requirements are being taught in design. The findings from this first step suggested that there was a lack of tools used to explaining requirements. The second phase therefore aimed at understanding the effects of this absence and observing how students apply what they learned on requirements. This was accomplished by performing a case study on student's industry sponsored projects. Findings suggested that a requirement becomes more specific as the project progresses and that there is no tool that can help them to methodically track changes within requirements. The last phase consisted in experimentally observing how requirements impact a specific idea generation task [32].

In the same year, the impact that functional, non-functional, and mixed requirements have on ideas generated was also observed [33]. These are assessed using the quantity, quality, variety, and novelty metrics. This is useful in determining the type of requirement that matters when solving a design problem [15].

Another study on requirements focuses on linguistics by looking at semantics [34]. The aim of this study was to improve requirements by making changes early in the design process. The research compares five different methods of analyzing requirements and improves upon the solely syntactic and string-matching analyses by adding the semantic aspect. Semantic analyzers were found to perform better than the syntactic ones and are key to determine the relationship between requirements [35].

The most recent work was a case study focused on the evolution of requirements over a twelve-month period [36]. This was accomplished by performing a deep dive into the requirement culture of the company through interviews. Findings show that the change of requirements can be due to changes in leadership, market strategy, and learning curve in writing requirements that can be tested [37].

As outlined, a significant amount of research has been conducted over the years within CEDAR on engineering requirements. This study, however, is the first to observe the impact that a lecture has on the student's list of requirements. The goal of this thesis is to fill this gap.

This work is primarily reported through the mechanical engineering design community's conferences. Table 1.1 illustrates other studies at these conferences focused on requirements. This collection of papers was gathered searching for "engineering design" and requirements, returning 167 papers. Each paper was examined for content and whether it was a study focused on requirements. This resulted in seven papers beyond those that were the result of CEDAR research, as found in Table 1.1. The CEDAR papers are shaded in gray and the external papers unshaded. The first and second column show the reference of the conference paper and year of publication. The third column displays the type of study performed, while the fourth column shows the number of participants used. Whether the study uses the quantity, quality, variety, and novelty metrics is shown in the fifth column. Where information is not provided within the reference, the cells are left empty to emphasize the evolution of the research community.

Table 1.1. Engineering Requirement Conference Papers

Reference	Year	Type of Study	Number of Participants	Metrics
[38]	2002	C.S.		
[39]	2008	D.S.		
[17]	2009	C.S.		
[25]	2009	S.S.		
[40]	2009	D.S.		
[41]	2009	D.S.		
[20]	2010	C.S.		
[22]	2010	C.S.	4	
[42]	2011	C.S.		
[43]	2011	tangential		
[44]	2012	C.S.	14	
[28]	2012	C.S.	7	
[30]	2012	D.S.		
[35]	2013	S.S.		
[45]	2015	C.S.	16	
[15]	2015	E.S.	47	Q,Q
[46]	2015	D.S.		
[47]	2015	C.S.	16	
[37]	2018	C.S.	3	
*Shaded rows = CEDAR studies, D.S. = Demonstration Study, C.S. = Case Study, E.S. = Experimental Study, S.S. = Simulation Study				

1.2 Research Scope and Organization

This study is a step forward in understanding the impact of educational interventions in the engineering design realm. To achieve this goal, the engineering requirement generation task is studied as impacted by lecturing as an intervention. Thus, a background on requirements is described in Chapter Two. Chapter Three provides a background on experimental studies in engineering design. Chapter Four explains the details of the experiment and data analysis. Results for problem validation are described in Chapter Five and results from the intervention of the lecture are provided in Chapter Six. The second experiment using practitioners is expanded upon in Chapter Seven. In Chapter Eight, a conclusion and limitations of this research are given, followed by future work (Chapter Nine).

Chapter Two
BACKGROUND ON REQUIREMENTS

This chapter provides a definition for engineering design requirements, contextualizing the research. Next, how requirements can be classified by constraints and criteria, functional and non-functional, with and without targets, and sources are discussed.

2.1 Requirement Definition

Developing a list of engineering requirements is considered one of the key characteristics of what is deemed best practice in design [3]. Engineering requirements are the wants, needs, and characteristics that the final solution should address [48]. The needs can be set by the designer herself, or from external sources such as the customer or the stakeholder [48]. This can depend on the type of design process: user-centered or empathetic. User-centered design focuses on the voice of the customer by "listening" to their needs [49], while empathetic design focuses on understanding the customer through experience [50]. Engineering requirements may be documented by using a Product Definition Specification (PDS) worksheet. This list is updated continuously throughout the development of the product. For example, in a study conducted on requirement evolution, recommendations were made on how requirements should be introduced at an early stage in the design process and how they should evolve throughout the entire project [32]. Typically, requirements are divided into constraints, which are a go/no go situation, and criteria, which are used to compare solutions [1]. Table 2.1 shows an example abbreviated PDS document.

Table 2.1. Example Abbreviated Product Definition Specification (PDS) Document

No.	Requirement	Constraint	Target Value	Given by	Checked by	Checked on
1	The device should cost less than $50	NO	$50	Customer	David	01/27/19
2	The device must be automatic	YES	N/A	Stakeholder	Caty	01/27/19
3	The device must be portable	YES	N/A	Designer	David	02/02/19
4	The device must be quiet	YES	50db	Stakeholder	Caty	03/04/19
5	The device must be easy to install without special assistance	YES	N/A	Designer	Caty	03/04/19

The first column portrays the requirement number. The second column shows the requirement, while the third column indicates whether the requirement is a constraint or not. If it is not a constraint, then it is a criterion (see section 2.2.1). Further, the fourth column sets a quantitative numerical value that functions as a target to meet when testing the product (see section 2.2.3). The last three columns indicate who the requirement was given by, when and by whom it was verified (see section 2.2.4). Some other categories that could be included in a full Product Design Specifications document are critical weight, a justification, the date the requirement was given on, and a verification method. The critical weight assigns a value to the requirement based on its criticality or level of importance. The justification gives a more detailed description of the requirement. The verification method is used to determine how to validate the requirement.

The requirement statement should be written to include, ideally, a subject, a predicate, and a modal [19]. The subject indicates what the requirement is about. The predicate specifies the characteristic of the product. The modal indicates the level of necessity of the requirement. The highest-level parts of a sentence are the subject and predicate [51], and are treated as such in this research (see section 4.6.2).

2.2 Requirement Classification

Engineering requirements can be classified into different categories, each with a different purpose. Requirements can be categorized, at a high level, by whether they are considered a criterion or a constraint. At a more detailed level, requirements can be classified as functional or non-functional. Some requirements can also be assigned a target value. Further, requirements can be classified according to their source. These ways of classifying a requirement are described in the following sections.

2.2.1 Constraints and Criteria

There can be two types of requirements: soft and hard. Hard requirements are a go/no-go situation in which the requirement must be met, also referred to as a "constraint" [1,52,53]. An example of this type of requirement is shown in Table 2.1, numbers 2-5. A soft requirement, or "criteria", is used as guidance and represents a desirable product trait, but not necessarily a mandatory one [1,52,53]. An example of this type of requirement would be: "The engine should be gray" or number 1 in Table 2.1.

There are different views on classifying requirements as criteria or constraints. A first point of view is provided in [53]. To understand a client's problem, a set of objectives and constraints are needed. The "objectives" or "goals" are criteria, meaning they are desired characteristics of the design. The constraints are specific limitations that the design must satisfy to be suitable. The examples provided use the word “must” for requirement constraints and the word “should” for requirement criteria.

A similar view is provided in [1]. This engineering design textbook categorizes constraints and criteria as demands and wishes respectively. Demands are requirements that *must* be met, while wishes *should* be satisfied when possible. Wishes should also be attributed with a level of importance, weighted as: major, medium, or minor.

A different perspective is instead provided by [52]. In this case it specifically states to avoid the words “must” and “should” and not classify the requirements into constraints and criteria but rather organize them into a hierarchy and subsequently establish their importance.

Thus, while all authors recognize the distinction between constraints and criteria, it is not clear whether these should be used to delineate or whether they might artificially constrain the problem from the engineer’s point of view. Resolving this debate is out of scope for this thesis.

2.2.2 Functional and Non-functional

Requirements can also be distinguished between functional and non-functional. This distinction is key for the success of the final design because important factors such as cost, market time, and quality can be difficult to prioritize if non-functional requirements are not clearly defined and tracked throughout the project [54].

A functional requirement describes the behavior of the system [1]. These behaviors are in sustenance of goals and activities. This definition of functional requirements observes the behavioral relationship between the inputs and outputs of the system. This type of requirement usually includes a transformative or active verb [32]. Another definition of a functional requirement, called “functions”, considers the actions that the product must perform to be successful [53]. These functions can be described in terms of the action verb “do” and are expressed specifically for the engineer. Further, a functional requirement specifies *what* the system should do, not *how* [52]. An example of this type of requirement is found in Table 2.1, numbers 2, 3 and 4.

On the other hand, a non-functional requirement does not address the system’s function but rather focuses on external limitations and thus constrains *how* the system should behave [55]. These are descriptions of the characteristics of the system and originate from the functional requirements [32]. They usually include the verbs “to be” or “to have”. Another definition for a non-functional requirement is as an attribute and quality of the design, such as reliability, safety, performance, security, customizability [54,56]. These classifications are referred to as the “-ilities” or “-ities” and are non-functional requirements denoted as “affordances”. Affordances relate the behavior of a system to its form [56]. An example of a non-functional requirement is numbers 1 and 5 in Table 2.1. Non-functional requirements are harder to define than functional requirements. They are the most expensive type of requirement to correct and hardest to satisfy [54]. Projects fail due to the omittance and imprecision in delineating this type of requirement.

Essentially, a non-functional requirement is one in which the predicate is a “being” or a “having” verb while functional requirements are those that have action verbs in the predicate statement [32]. It has been shown that the ratio of functional to non-functional requirements can be useful in project management [32].

2.2.3 Targets

Requirements can also be classified according to whether they include a target value or not. Examples can be found in Table 2.1. Requirements number 1 and 4 include target values. Targets are quantitative numerical values that the requirement should meet [1]. Setting a target adds details and specificity to the requirement [52]. Further, a target value is also useful when testing design prototypes. By meeting the target value, the requirement is satisfied. Even though most requirements should be quantified, some requirements do not have a target value but must still be described clearly [1].

2.2.4 Sources

Requirement sources refer from whom requirements come. These sources can be the client, the designer, the user, or government regulation, for example [53]. The client is a person or group that wants the creation of the product and they can either be external or internal to the company. The designer develops requirements that satisfy all sources. The user is the person or group of people who will use the product once it is created, and therefore has different requirements than the client and the designer, that must be satisfied. Categorizing and recording the source of the requirement can be useful in keeping track of changes, additions, and responsibilities [1]. A similar perspective on requirement sources includes all stakeholders that are affected by the characteristics of the design [52]. This list includes all parties within the company (marketing, sales, manufacturing, engineering, production, etc.) as well as the end user that will be using the product and the client who will buy the product and then sell it to the end user. The government, with its legal and safety regulations, is another source of requirements that must be sustained for the product to be approved.

2.3 Summary of Requirement Background

This thesis focuses on the definition or generation of requirements early in the design process. This chapter provided a background on requirements including their definition and classification.

Chapter Three
EXPERIMENT BACKGROUND

A background on the experiment is outlined in this chapter. An explanation of what is being measured, what is being controlled, and why similar problems are needed for this study is provided.

3.1 What to measure: Design Ideation Metrics

Engineering ideation methods may be measured and assessed through four metrics: quantity, quality, variety, and novelty [57]. While these metrics were originally developed to compare methods for exploring the problem space, they are adapted here for evaluation requirement definition methods [57]. Quantity is the total amount of generated ideas, while quality is how achievable the idea generated is [57]. A measure of the diverse solutions generated in the ideation phase represents variety, while novelty is how unique an idea is compared to the other ideas generated [57].

Further research has been done on extensions of these metrics [58–60]. Design solutions can be identified as adaptive, novel, or redesign using a weighted sum approach on scoring concept elements and assigning a greater value to the novel element [58]. A metric that can be used in place of novelty is originality [61]. This originality metric is assessed by using an eleven-point scale to rate the solutions' characteristics. Furthermore, challenges with the novelty metric are identified regarding its calculations and evaluations [59]. Variety and quantity have been explored and merged into a single metric to remove any repetitions that may occur within the design space [60].

These metrics have been adapted to this study. In this work, the purpose of these metrics is to decompose each requirement into its basic elements. Quantity refers to how many requirements are generated by each participant. The level of completeness refers to the requirement elements tagged through grammar and parts of speech. Therefore, the requirement is scored as to whether it includes a subject, verb, and modal. Variety is assessed by determining to which categories the requirement belongs [1], while novelty assesses how unique the requirement is by using Latent Semantic Analysis to compare requirement meaning.

3.2 What to control: Intervention

Within the design community, studies exist that address topics such as creativity and ideation with capstone fourth year design students. However, little research exists in engineering design on whether lecture intervention changes the student's behavior in design tasks. A few examples of design education studies that address the "how to" teach design aspect rather than the impact on the student's behaviors are found in Table 3.1.

Table 3.1. Examples of Design Education Studies

Reference	Stage	Type of Intervention	Impact of Intervention	Duration
[5]	C-E-D	Positive reinforcement	-	Semester
[6]	C-E-D	None	-	-
[7]	C	Designette	Increase self-efficacy	90 min, 120 min, semester
[8]	C-E-D	Type of “mentoring”	Virtual increased performance	Semester
[9]	C-E-D	Feedback during design reviews	Positive in applying analogies	Semester
[10]	C-E-D	Motivation	-	Semester
[11]	C	Problem framing, design tools, teaming	Quality	Two sessions
[12]	C-E-D	Team Formation	-	Semester
*C = Conceptual Design, E = Embodiment Design, D = Detailed Design				

The first column shows the reference of the study. The second column shows the design process stage each study addresses. The next two columns address whether there is an intervention and what type of intervention it is. The last column addresses the duration of the intervention. As shown by Table 3.1, the studies all address engineering design education. The first study is not an experiment, but rather an account of the current practice of engineering design education [5]. The intervention lies in explaining that design is based on behavior and that teaching design impacts the behavior of the student. Thus, an environment that urges positive behaviors must be established. The benefits that the students may gain from using text processing is also explored [6], and a new approach to how to teach design called “designettes” is addressed and found to increase the student’s self-efficacy [7]. The impact of using the web or faculty to mentor the student on design is observed and the web-guided method was found to increase student performance [8]. Another research on design education addresses the intervention of design review feedback, which resulted in a positive impact in applying analogies [9]. Further, types of interventions are addressed [10], as well as team formation [12], without addressing their impact on the students. A study that is similar to this research specifically focuses on different types of interventions (problem framing, design tools, and teaming) and their impact on quality [11]. However, none of the listed studies specifically addresses the impact that a lecture intervention has on students.

Little research has been performed on how engineering requirements are taught in design education [14]. It has been found that design textbooks that do mention requirements do not provide guidance on details such as target number and type of requirements. A protocol was developed for how requirements should be explained and divided into three main categories: requirement type, number, and selection strategy [14]. Requirement type addresses whether a requirement is functional or non-functional. The number of requirements refers to how many requirements are generated, while the selection strategy refers to how requirements are identified (random or systematic). Students should also be taught that requirements should be identified at an early stage within the design process [14]. Furthermore, concrete examples through an idea generation process should be provided for the students to understand the types and number of requirements [14].

Another study that investigates how requirements should be taught develops an organized "teardown process" [13]. This approach is comprised of six phases: initial specifications, observations and practice, teardown, design variable identification, benchmarking, and redesign. The initial specifications phase consists in introducing the students to the design process and to engineering requirements. The second phase involves giving the students a product and creating a first list of requirements. The teardown phase consists in identifying and subdividing the product into its main components and functions and generating more detailed specifications. The design variable phase involves creating a bill of materials, analyzing the mechanism and structure of the product, performing a structural integrity analysis, examining the performance of the specifications, and generating design variables. Subsequently, the benchmarking phase consists in identifying products that are similar in function. The last phase entails redesigning a variation of the original product by satisfying additional specifications. All phases include tasks and outcomes that lead to information on requirement generation. The specifications are a working document that changes and progresses throughout all phases, until all variables, quantitative, and qualitative measures are collected and expressed into coherent sentences. This is similar to what is presented in [4]. Thus, it can be concluded that research in engineering design education addresses the "how to" aspect of teaching instead of the impact that a lecture intervention has on the students. This is also valid for the specific area of engineering requirements within design.

This thesis focuses on identifying the impact that a lecture has on how the students generate requirements. Thus, it addresses the effects of a lecture. To reiterate, it seeks to answer the question: *How does a 50-minute lecture impact the requirements generated?*

3.3 Why similar problems needed

Design prompts are important when generating and assessing solutions. Researchers use the way design prompts are presented to restrict the solution space by elements such as its format, purpose, and content. By limiting the solution space, the solution is more focused, and therefore it is easier to explore a solution within this space

[62]. Design problems are also used to expand the design space. Thus, prompts focus on a specific solution space that addresses a deeper and extended design space. However, other approaches view the problem and the solution as co-evolving [63]. This means that the design problem and the solution progress in combination with one another.

Existing literature addresses how the design problem affects the solution. A variety of design problems have been used to study requirements, functions, and conceptual design. When using more than one prompt in an experiment, problem similarity becomes crucial. The equivalency of more than one design problem is determined by the similarity of the solutions produced. Creating equivalent design prompts remains a challenge since they must encourage quality, quantity, novelty, and variety while limiting fixation [64]. Work has been done to identify different elements of a design problem [65,66] as well as investigating problem similarity [65,67]. The degree of similarity of many design problems was assessed based on their representation using Latent Semantic Analysis [65]. The complexity of design problems was divided into three different categories: size, solvability, and coupling [68]. The equivalency of four design problems was also observed based on the metrics of quantity, variety, novelty, completeness, and quality [65,67]. On the other hand, it has been argued that the design problem is not what drives the solution, but rather the experience level of the designer [69]. These works are an effort to better understand design problems and their purpose within engineering design.

A non-exhaustive review of design problems used in engineering design literature is provided in Table 3.2. In the table, the cells are coded as P (Problem) or S (Solution) depending on what was analyzed by the study. The column on the far right indicates how many problems were used in each experiment. The shaded row at the bottom shows the frequency of each design problem used throughout the studies. The rows on the left are numbered 1-14 and show the studies with their respective university affiliations. The top row displays the design problems used in the studies, lettered A-N. At the very bottom of the table, a legend is shown to describe the university abbreviations.

Table 3.2. Design Prompts in Literature

Number	**Study Reference**	**University Affiliation**	**Design Problem**														**Number of Problems**
			A	B	C	D	E	F	G	H	I	J	K	L	M	N	
			Chocolate Packaging	Drinking Fountain	Peanut Shelling	Corn Husking	Coconut Harvesting	Personal Alarm Clock	Bike Safety Lock	Book Picking [a]	Blind Cup	Clothes Ironing	Recycling Sorter [b]	Spill proof coffee cup	Bike Rack	Burrito Folding	
1	[70]	CU	-	-	-	-	-	-	-	-	-	S	S	-	-	-	2
2	[67]	GT	-	-	P	P	P	P	-	-	-	-	-	-	-	-	4
3	[71]	CU	-	-	-	-	-	-	-	-	-	S	S	-	-	-	2
4	[66]	GT	-	-	S	S	-	S	-	-	S	-	-	-	-	-	4
5	[15]	CU	-	-	-	-	-	-	-	-	-	-	-	-	-	S	1
6	[72]	CU	-	-	-	-	-	-	-	-	-	-	-	-	-	S	1
7	[73]	DU	-	-	-	-	-	-	-	S	-	-	-	-	-	-	1
8	[74]	GT	-	-	S	-	-	-	-	-	-	-	-	-	-	-	1
9	[75]	GT	-	-	S	-	-	-	-	-	-	-	-	-	-	-	1
10	[76]	GT	-	-	S	-	-	-	-	-	-	-	-	-	-	-	1
11	[77]	IT	S	S	-	-	-	-	-	-	-	-	-	-	-	-	2
12	[78]	CU	-	-	-	-	-	-	-	-	-	-	-	-	-	S	1
13	[79]	ASU	-	-	-	-	-	-	S	S	-	-	-	-	-	-	2
14	[80]	TA	-	-	-	-	-	-	-	-	S	-	-	S	S	-	3
Frequency			1	1	5	2	1	2	1	2	2	2	2	1	1	3	

University Affiliation: CU - Clemson University; GT - Georgia Tech; DU - Delft University of Technology; IT- Israel Tech; ASU – Arizona State University TA – Texas A&M

Analysis Type: P – Problem focused; S – Solution focused;

[a] Similar to peach picking [81]
[b] Similar to trash disposal system [63]

Table 3.2 provides insight into the design problems used in literature. Study 2 is the only one that focuses on the problem space. This study discusses problem similarity by comparing problems C, D, E, and F and evaluating them using the ideation metrics of quality, quantity, variety, and novelty [82]. All other studies listed use design problems for idea generation methods or design fixation and analyze the solutions generated by the participants. Data presented in Table 3.2 also suggests that problems are reused within the same university but not across different ones. For example, Georgia Tech reuses C, D, E, and F, while Clemson University reuses problems J, K, and N. Additionally, it is important to note that the recycling sorter prompt (K) was derived from the litter disposal system design problem [63]. Similarly, a peach picking problem was created from the book picking prompt (H) [81]. Overall, the most frequently used problem statement is C, used repeatedly from studies conducted at Georgia Tech. This is not an exhaustive review of the problems used in engineering design research, but representative for the purposes of this research.

Another important takeaway is that not all studies use two or more design problems in the same experiment. Study 14 reports on three distinct experiments, each employing a different design problem. Likewise, study 11 details two experiments each with a unique design problem. On the other hand, studies 1, 3, and 13 use two problems for one experiment. Studies 2 and 4 also use four problems to support each experiment reported. The rest of the listed literature, however, uses only one design prompt for one experiment.

An integrated approach was developed to help researchers develop similar design problems to boost repetition and increase the statistical power of resulting observations

[83]. The number of design problems needed depends on the number of available participants. For example, when a significantly large sample size can be achieved with the available participants, a single design problem may be sufficient. However, when fewer participants are available, multiple design problems can be used to increase the sample size by extracting more than one response from each participant. Therefore, using multiple design problems, can help researchers increase replication and subsequently the statistical power of tests conducted. Further, a procedure was proposed for developing similar design prompts and validating the similarity based on the observations as well as participant perceptions [83].

Chapter Four
EXPERIMENT

An experiment was performed to assess the impact that the intervention has on the requirements generated by the students. A description of the experiment performed is outlined below.

4.1 Controlled Experiment

The main objective of the experiment was to understand the effect that a lecture had on the student's ability to generate requirements. A secondary objective involved comparing the design problems for similarity. Specifically, the methodological questions to answer are the following:

MQ1. Are the two problems given to the students the same with respect to quantity?

MQ2. Are the two problems given to the students the same with respect to completeness?

MQ3. Are the two problems given to the students the same with respect to variety?

MQ4. Are the two problems given to the students the same with respect to novelty?

A controlled experiment was designed to address the research questions. A protocol was also conducted for interrater reliability verification purposes to analyze the variety metric data.

4.2 Variables Tested

The independent variable for this study is the lecture intervention. Requirements for quantity and completeness were examined by the individual student. Requirements for variety and novelty, were evaluated by each requirement. The control variables that were held constant throughout the experiment were the given instructions and the number of students that received the problems. Further, the participant's personalities, gender, and age were controlled by random assignment.

4.3 Design Problems

To perform the experiment, two design problems were initially chosen from existing literature. Both design problems were selected from the same engineering study [79]. That study used them for a representation mapping experiment in which participants had to generate textual and pictorial solutions. The first design problem (Problem A) challenges the participants to design a device that would help people in wheelchairs take books from a bookshelf. The second design problem (Problem B) focuses on designing a permanent safety lock for a bicycle. As the lecture intervention study requires each participant to complete a before and after task, two comparable problems are needed. They had to be similar enough to not generate an unbalanced and significantly different number of requirements. However, the problems were supposed to be different enough to not replicate the same content to avoid learning effect. The problems also had to be consistent across different cultures and applicable to the real world. Furthermore, they were supposed to be easy enough to be read by mechanical engineering fourth year students since the activity had to be completed within 10 minutes. The two problems are showed below (see Table 4.1). In literature, a modification of Problem A was created and previously used in a requirement experiment [81]. This alternative problem statement asked participants to design a device that would help people in wheelchairs pick peaches from a tree instead of a bookshelf [81]. Thus, it is argued that these problems are suitable for this type of study.

Table 4.1. Design Problems adapted from [79]

Problem A: Bookshelf
In order to help people in wheel chairs to grab books from the highest level of the bookshelf (at 6 ft or above), a mechanism needs to be developed. The device must be safe to use, convenient, and operate smoothly without damaging the books. The assembly should be relatively simple so that it can be installed on most existing bookshelves.
Problem B: Bicycle Lock
Design a safety lock for a bicycle that is to be permanently fastened to it (not to be removed when being used). The lock is to be a lasting accessory, yet can still be removed or adjusted if necessary. It should be small enough to be non-obtrusive to the bicyclist while riding and should be light weight and relatively inexpensive.

The original wording of the problems was altered to ensure that they were similar in their structure, considering elements such as word count, characters, paragraphs, number of sentences, Flesch Reading Ease, and reading grade level. In addition, the number of embedded requirements was the same at five each. In Problem A, the device must be safe, convenient, operate smoothly, not damage the books, and simple. In Problem B, the device should last long, be removed or adjusted, small, lightweight, and inexpensive. A numerical comparison of these elements for Problems A and B is shown in Table 4.2. The differences in percentages range from 0% to 9%, which are relatively low. This suggests that, based on the metrics analyzed, the two problems are similar. Moreover, both problem statements clearly ask for a solution to be developed. The structure of the content is similar as well since both problems start with a brief description of the goal, followed by the constraints and criteria. Since the problems are purposefully developed to be similar, it is expected that the number of requirements generated by the students will not be significantly different between the two problems for the same stage (pre or post intervention).

Table 4.2. Problem Similarity Pre-verification

Metrics	Book Problem	Safety Lock Problem	Relative Difference
Word Count	60	60	0%
Characters	281	274	2%
Paragraphs	1	1	0%
Sentences	3	3	0%
Sentences per paragraph	3	3	0%
Words per sentence	20	20	0%
Characters per word	4.5	4.4	2%
Flesch Reading Ease	61	55.4	9%
Grade Level	9.7	10.5	8%
Number of embedded requirements	5	5	0%

4.4 Participants

The participants for this experiment were fourth year undergraduate mechanical engineering students. The participants were all enrolled in a required mechanical engineering design course (ME4010) and the experiment was performed during class time. The participants had basic to little knowledge of engineering requirements, which is why they were selected for this study and could be considered novice engineers. Table 4.3 shows examples of participants used in studies performed with engineering design problems. The first column indicates the reference of the studies, the second column shows the class level and type of discipline (if specified) of the participants, the third column shows how many participants took part in each study, and the fourth column represents the reason given for choosing these participants. These studies are ordered chronologically from most recent to oldest.

Table 4.3. Participants in Literature (as reported)

Reference	Year in School	Discipline	Number of Participants	Justification
[70]	3	ME	67	N/A
[71]	4	ME	86	"reasonable representation of novice engineers who would be using design tools such as function structures for novel design"
[66]	4	Interdisciplinary	32 21	Virgin population
[84]	2	ME	47	N/A
[72]	4	ME	50	Close to being practicing professionals but still novice
[81]	4	ME	45	Familiar with requirements and idea generation
[73]	4-5	Unknown	60	Industrial design background
[85]	4	ME	24	Limited practice and knowledge of fabrication processes
[74]	4	ME	60	Experience with working in teams and some work experience and knowledge of mechanical theory
[75]	4	ME	92	Accustomed to working with each other when solving engineering design problems
[86]	4	ME	N/A	N/A
[77]	4-5	Unknown	36	Took design studio classes
[87]	2	ME	N/A	Experience with morphological charts
[79]	3		89	N/A
[63]	"Professionals"		9	Worked in design consultancies
[88]	4	Unknown	50	N/A
[80]	4	Unknown	25	N/A

As shown by the level in school, most of the participants are in the third or fourth year in the curriculum. The course in which the participants were enrolled was not declared by all. Furthermore, over time, giving a justification for why that specific group of participants has been selected, has increasingly been included in the papers. In addition, the number of participants has been stated in the studies more frequently but has remained in the same range (20-90).

A total of 120 students participated in this study. Each participant was distinguished from the others by using a self-generated unique code. It was generated by following these instructions:

"Please provide the first two letters of your mother's first name followed by the date of the month you were born on (2 digits) in the space below. For example: my mother's first name is Stefania and I was born on the fourth of July. Therefore, mine would be: ST04."

This enabled the participants to remain anonymous while allowing the researcher to distinguish each participant. It is important to note that some codes generated were the same. When this happened, the letters "A" or "B" were added at the end of the identification code to differentiate them based on comparing and matching their handwriting samples from the before and after responses.

4.5 Execution Procedure

With the permission of the professor, the experiment was performed during a regular class period. As soon as the lecture started, the participants were told that they were going to start the class with an activity on engineering requirements. Two experiment packets (see Appendix A) were distributed randomly with the same format and instructions, but different problem statements: one with Problem A and the other with Problem B. About half of the class (51 students) were given the packet with Problem A. For the purpose of this paper, this group of students will be referred as Group 1. The other 69 students (Group 2) were given the experiment packet with Problem B. The participants had ten minutes to complete the activity. A fifty-minute lecture on engineering requirements was then given by the professor. Typically, the class used a projected PowerPoint with lecture slides, previously distributed to the students. However, on the day of the experiment, the projector was not operational, and the lecture was performed with the use of a whiteboard and examples. The professor had taught this class for a total of twelve semesters. For the class in which the experiment was conducted, the professor taught engineering requirements, specifically the Kano Diagram, Utility graphs, criterion vs. constraint, and Requirement Checklist. For the Kano Diagram, students were taught requirements as basic needs versus requirements that provide excitement. Utility graphs are used to evaluate the intrinsic worth of an alternative to evaluate requirements. The difference between a criterion versus a constraint were also taught during the class. Further, the Requirement Checklist method was taught to use as a guideline to cover all requirement categories (i.e. Function, Safety, Ergonomics, Production, Costs, Schedules). This checklist is shown in section 4.6.3. Towards the end of the class period, the same ten-minute activity was repeated by exchanging problems and giving Problem B to Group 1 and Problem A to Group 2. At the end of the second activity, before leaving class, students completed a survey to establish their level of experience with engineering requirements. For a complete list of the requirements generated see Appendix B. Table 4.4 below shows the experimental layout. It may be noted that requirements were a critical concept in the course as the word “requirement” was repeated 656 times throughout the semester by the instructor.

Table 4.4. Experimental Layout

Group 1		Group 2	
Before Lecture	After Lecture	Before Lecture	After Lecture
Problem A	Problem B	Problem B	Problem A

4.6 Data Processing and Analysis

The data for quantity was examined by counting the number of requirements manually using three passes. The completeness data was gathered by analyzing the grammar of each requirement (subject, verb, modal). The variety data was evaluated using a checklist, while the novelty data was analyzed by using the LSA tool.

4.6.1 Coding Scheme

The data was coded based on the scheme shown in Table 4.5. The letters A and B represent Problem A and Problem B accordingly. The number 1 stands for "before lecture" and number 2 for "after lecture".

Table 4.5 Coding Scheme

A1		**B1**		**A2**		**B2**	
Problem A (Book picking problem)	Before Lecture	Problem B (Safety lock problem)	Before Lecture	Problem A (Book picking problem)	After Lecture	Problem B (Safety lock problem)	After Lecture

4.6.2 Quantity

The data processed from this metric was the number of requirements generated by each student from the given problem statement. This information was manually input into Microsoft Excel by counting the number of requirements three times. For the first count, every line was counted as a requirement, even if it was incomplete or not pertaining to the problem. For the second count, only requirements that addressed the problem were counted. For the third count, sentences had to have a clear implicit subject and an explicit verb to be counted as a requirement (for a full list of the data result counts, please see Appendix C). Excerpts from the original experiment packet are shown in Table 4.5.

Table 4.6. Scan from Experiment Packet

Raw	Count		
	1	**2**	**3**
Shall be operated by single joystick	X	X	X
Shall be operated by single joystick			
Shall allow patrons to access shelves if not operating mechanism	X	X	X
Shall allow patrons to access shelves if not operating mechanism			
easy manuverability without intricate design	X	X	-
Easy manuverability without intricate design			
easy usability (button activation/mechanical grabbing)	X	X	-
Easy usability (button activation/mechanical grabbing)			
Shall hav	X	-	-
Shall hav			

The data was compared as shown in Table 4.6. The similarity of the two problems was determined by comparing Problem A to Problem B before lecture (A1, B1), and Problem A to Problem B after lecture (A2, B2). The impact of teaching intervention was determined by comparing Problem B before lecture to Problem A after lecture (B1A2) and Problem A before the lecture to Problem B after the lecture (A1B2).

Table 4.7. Quantity Problem Layout

	A1	**A2**	**B1**	**B2**
A1	-	-	S	I
A2	I	-	I	S
B1	S	I	-	I
B2	I	S	-	-
*I = Intervention, S = Similarity				

The data was analyzed by performing ANOVA tests and comparing the p-values found.

4.6.3 Completeness

The data collected from this analysis consisted in examining the requirement by its grammar, specifically looking at whether it included a subject, verb, or modal. This was accomplished using a weighted approach. If it had a subject then the requirement was given a value of 1, otherwise 0. If the requirement had a verb it was also given a value of 1, otherwise 0. The modal was instead weighted as 0.5. For a requirement to be complete it therefore had to have all three elements (subject, verb, and modal) and therefore add up to a score of 2.5 (see Appendix D). Other permutations and different weighting schemes could have been used. However, the logic behind using this weighting scheme was that, the two core parts of speech in a sentence are a subject and a verb (see section 2.1), and thus are weighted more than the modal. Examples of an incomplete requirement are: "overheating" or "should not overheat". A complete requirement would be: "Engine should not overheat". The data for completeness was then evaluated by performing an ANOVA test and comparing the p-values found.

4.6.4 Variety

A checklist based on eighteen categories (see Table 4.7) of requirements [1] was used to place the requirements into the correct group based on their content.

Table 4.8. Categories for Checklist [1]

Category	Specification
Geometry	Size, height, breadth, length, diameter, space, footprint
Kinematics	Type of motion, direction of motion, velocity, acceleration
Forces	Direction, magnitude, frequency, weight, load, stiffness, deformation
Energy	Output, efficiency, loss, friction, temperature, pressure
Material	Physical properties, chemical properties, prescribed materials (food processing)
Signals	Inputs, outputs, form, display, control equipment
Safety	Manufacturer, environmental, operator
Ergonomics	Man-machine relationship, aesthetics
Production	Factory limits, production methods, achievable tolerances
Quality Control	Testing, measurement, special regulations and standards
Assembly	Installation, siting, foundation
Transport	Lifting gear, clearance, means of transport
Operation	Noise, wear, marketing area, destination
Maintenance	Servicing intervals, inspection, exchange
Recycling	Reuse, reprocessing, waste disposal
Costs	Maximum manufacturing cost, tooling cost, investment and depreciation
Schedules	End date of development, project planning and control
N/A	If requirement does not fit in any of the categories

The data was first examined by developing a protocol to conduct an interrater reliability test.

4.6.4.1 Interrater Reliability Test

A protocol was developed to classify the requirements into the eighteen categories. The protocol was refined until an acceptable level of interrater agreement was reached. The final protocol instructions are:

1. *A list of requirements is given*
2. *Read one requirement at a time*

3. *Please categorize each requirement based on the table below by placing an 'x' under the correct category (column), making sure that it matches the requirement (row)*
4. *A requirement may have a maximum of 3 applicable categories*
5. *Leave other categories blank*

The final results from the interrater reliability test are shown in Table 4.8. A target threshold of 0.700 is deemed acceptable for agreements [89]. Only the "Not Applicable" category is found to be below the threshold. This category is used to allow raters to tag requirements that do not clearly fit the seventeen other types.

Table 4.9. Interrater Test Results

	Average
Geometry	0.915
Kinematics	0.966
Forces	0.881
Energy	0.966
Material	0.966
Signals	0.983
Safety	0.864
Ergonomics	0.881
Production	0.949
Quality Control	0.763
Assembly	0.949
Transport	0.966
Operation	0.932
Maintenance	1.000
Recycling	0.966
Costs	1.000
Schedules	1.000
N/A	0.593

Once the protocol was tested and shown to generate similar results, all 2912 requirements were categorized and coded by one person into the eighteen groups manually, following the protocol instructions (see Appendix E).

4.6.5 Novelty

The data for the novelty metric was collected by using the Latent Semantic Analysis (LSA) software[1] from University of Colorado [90]. This method has been used by others in the research community [90–92]. LSA is a method that analyses the given text using statistical computations and word frequency comparison. To do this, LSA places the database inputs or text entries into matrices and executes singular value decomposition. To compare the given text inputs, these are first placed in vector form and then computed using the cosine of the angle between these vectors. This generates a matrix with values comparing each text entry. Values that are close to or equal to 1 means that the words are similar while values that are close to 0 signify that they are dissimilar. Thus, the requirements were put into LSA by performing a matrix comparison and selecting a topic space of "General reading up to the 1st year of college" and a comparison type of "term by term". The output was a matrix that compared the sets of requirements of each student to one another with values between 0 to 1.

To identify the unique requirements, the data gathered from LSA was first imported into Excel and divided into the four sets of data: B1, B2, A1, and A2. A filter was then applied to select only the numbers that were less than 0.6, which meant that they were generally dissimilar. A sum of each row, and a count on the number of elements in each row that were less than 0.6, were then performed (see Appendix F). This was done for all four sets of data and then plotted on a graph (see Figure 4.1).

---

[1] http://lsa.colorado.edu/

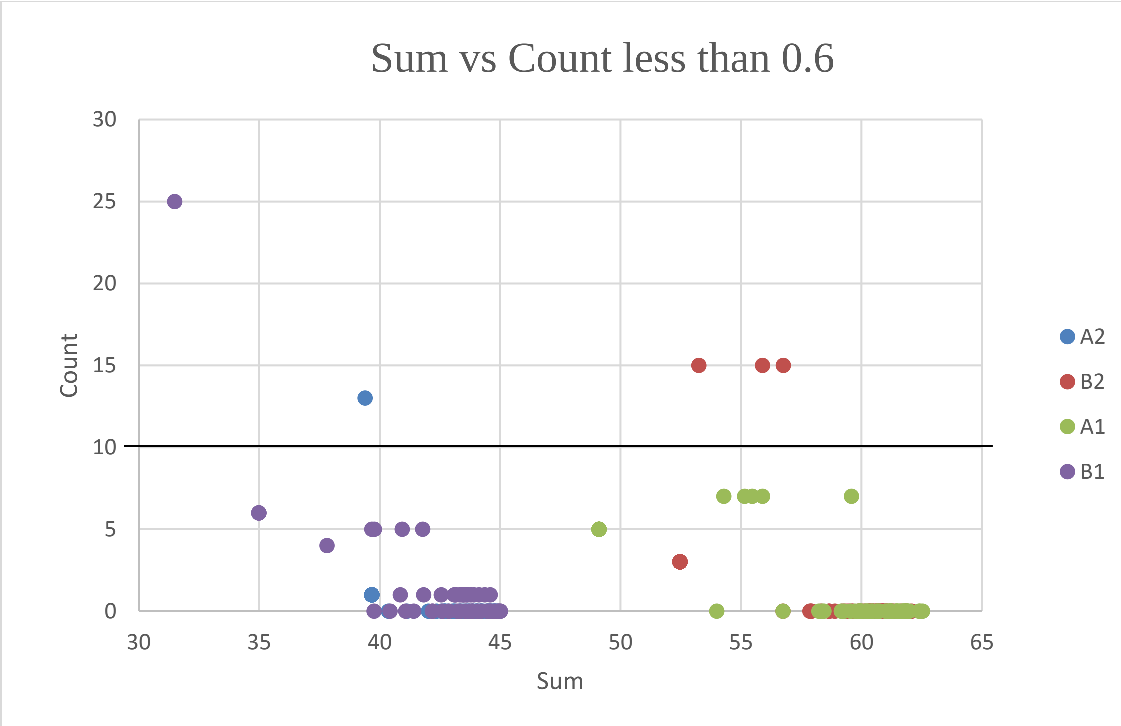


Figure 4.1. Unique Requirements Graphical Screening

By observing the data on the graph, an initial threshold for what requirements were considered unique was determined to be above ten (see black horizontal line mark). The requirements from the data were then extracted and examined individually by analysing their semantics manually. Further, their content was observed to filter the unique requirements by checking whether others exist based on their content. A schematic of the process is shown in Figure 4.2.

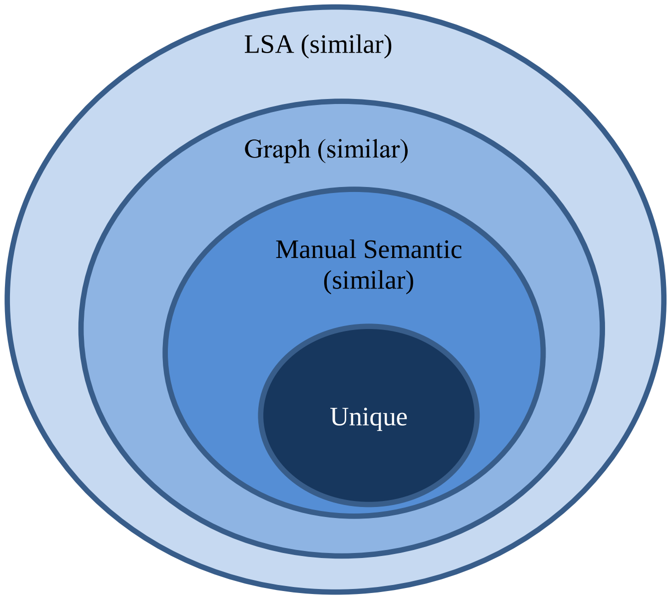


Figure 4.2. Filtering Process for Unique Requirements

4.6.6 Summary of Data

A summary of the data resolution and the units of analysis used for each metric are shown in Table 4.9.

Table 4.10. Data Processing and Analysis Summary

Metric	Resolution	Unit of Analysis
Quantity	Participant	Counting
Completeness	Participant	Weighting
Variety	Requirement	Checklist with Protocol
Novelty	Requirement	Filtering process

The type of resolution used for the quantity and completeness data was per participant. Variety and novelty instead were analysed per requirement. Further, quantity was evaluated by counting the requirements per participant. Completeness was assessed by assigning a weight to each requirement and averaging it per participant. Variety was analysed using a checklist to categorize each requirement. Novelty was assessed using a filtering process for each requirement and identifying the unique ones. Based on the data analysis, the results for a post-hoc problem validation and the influence of lecture intervention were found.

Chapter Five
RESULTS: VALIDATING THE PROMPT SIMILARITY POST HOC

To verify that the design prompts given to the students did not have a different effect on the requirements generated, a post-experiment verification is needed. This validation is performed for each metric.

5.1 Quantity Validation

A post-experiment verification was conducted to confirm that the two problem statements (prompts) are similar. The number of requirements for each of the design problems were grouped together. Responses to Problem A and Problem B from before the lecture were compared for each count (1,2, and 3). Responses to the two design problems given after the lecture were also compared. An ANOVA test was conducted to determine the similarity of the two design problems. The null hypothesis for this test was that the mean number of requirements generated for Problems A and B would be statistically equal, with the significance level (α) set to equal 0.15. The α=0.15 has been used in other studies in engineering design with student participants [93].

$$H_o(\mu_a = \mu_b)$$

$$H_a(\mu_a \neq \mu_b)$$

The results of the ANOVA test are shown in Tables 5.1-5.6. For each of the groups shown, the p-value exceeds the significance level, failing to reject the null hypothesis that the mean number of requirements generated are same.

Table 5.1. ANOVA Test Count 1 of Quantity Before Lecture Intervention

Groups	*Count*	*Sum*	*Average*	*Variance*	*P-value*
B1	51	487	9.5	14.8	0.4
A1	69	699	10.1	13.8	

Table 5.1 shows the results obtained from Count 1 when conducting ANOVA on the data obtained before the lecture comparing Problem A to Problem B. The results yield a p-value of 0.4 which is higher than the significance level of 0.15. This shows that the effect of the two problems on the mean number of requirements generated is not statistically different. Furthermore, the averages are close to one another with a percent difference of 6%, while the percent difference of the variances is of 7%.

Table 5.2. ANOVA Test Count 1 of Quantity After Lecture Intervention

Groups	*Count*	*Sum*	*Average*	*Variance*	*P-value*
B2	69	980	14.2	21.1	0.7
A2	51	743	14.6	29.4	

Table 5.2 shows the findings from Count 1, from the data collected after the lecture, comparing Problem A to Problem B. The averages are greater than those in Table 5.1 and are closer to one another with a percent difference of 3%. However, there is a greater discrepancy between the variances with a difference of 33%. The p-value of 0.7 shows that the effect of the two problems on the mean number of requirements generated is not statistically different.

Table 5.3. ANOVA Test Count 2 of Quantity Before Lecture Intervention

Groups	*Count*	*Sum*	*Average*	*Variance*	*P-value*
B1	51	485	9.5	14.9	0.4
A1	69	696	10.1	13.3	

The results in Table 5.3 compare Problem A to Problem B before the lecture for Count 2. The results, like Table 5.1, yield a p-value of 0.4 and a percent difference in the averages of 6%. The variance is slightly larger with a percent difference of 11%. The effect of the two problems on the mean number of requirements generated is not statistically different.

Table 5.4. ANOVA Test Count 2 of Quantity After Lecture Intervention

Groups	*Count*	*Sum*	*Average*	*Variance*	*P-value*
B2	69	977	14.2	21.1	0.6
A2	51	746	14.6	28.7	

The results in Table 5.4 are again similar to results in Table 5.2. The values of the average have increased compared to the count before the lecture. The averages are close to one another with a small percent difference of 3%. The variance values are farther apart from each other with a percent difference of 31%. This results in a p-value of 0.6 showing that the effect of Problems A and B on the mean number of requirements generated is not statistically different.

Table 5.5. ANOVA Test Count 3 of Quantity Before Lecture Intervention

Groups	*Count*	*Sum*	*Average*	*Variance*	*P-value*
B1	51	361	7.1	12.3	0.1
A1	69	565	8.2	10.7	

Table 5.5 shows a comparison of Count 3 between Problem A and Problem B from the data collected before the lecture. The average values have a percent difference of 14%. The variances are close to one another with a percent difference of 14%. Both the average and the variance values yield a percent difference of 14%. However, the p-value is 0.1

which is less than the significance level of 0.15. Thus, the effect of the problems on the mean number of requirements generated is statistically different.

Table 5.6. ANOVA Test on Count 3 of Quantity After Lecture Intervention

Groups	*Count*	*Sum*	*Average*	*Variance*	*P-value*
B2	69	803	11.6	25.9	0.3
A2	51	641	12.6	19.5	

Table 5.6 shows an increase in the average values from Table 5.5. The percent difference between the two averages is of 8%. The gap between the two variance values is larger with a percent difference of 28%. The p-value is 0.3 which means that the effect of the problems on the mean number of requirements generated is not statistically different.

In summary, since the problems were not found to result in significant differences in five of six tests, it is concluded that the problems are similar enough to allow for a fair comparison of before and after performance using the two problems.

5.2 Completeness Validation

A similar approach to quantity was conducted in completeness to validate the design problems. The requirement weighting for each of the problems were group and compared to one another before lecture and after lecture. An ANOVA test was used to determine problem similarity.

The null hypothesis for this test was that the mean number of complete requirements generated for Problems A and B would be statistically equal, with a significance level (α) of 0.15.

$$H_o(\mu_a = \mu_b)$$

$$H_a(\mu_a \neq \mu_b)$$

The results of the ANOVA test are shown in Tables 5.7 and 5.8. When the p-value exceeds the significance level, it fails to reject the null hypothesis that the mean number of complete requirements generated are statistically equal.

Table 5.7. ANOVA Test on Completeness Before Lecture Intervention

Groups	*Count*	*Sum*	*Average*	*Variance*	*P-value*
B1	51	72.10	1.41	0.58	0.21
A1	69	87.31	1.27	0.28	

Table 5.7 shows the results obtained when conducting ANOVA on the data gathered from the number of complete requirements before the lecture comparing Problem A to Problem B. The results yield a p-value of 0.21 which is higher than the significance level of 0.15. Thus, the effect of the two problems on the mean number of complete requirements is not statistically different. Further, the averages are close to one another with a percent difference of 10%.

Table 5.8. ANOVA Test on Completeness After Lecture Intervention

Groups	*Count*	*Sum*	*Average*	*Variance*	*P-value*
B2	69	89.47	1.30	0.30	0.11
A2	51	74.64	1.46	0.34	

Table 5.8 shows a comparison between Problem A and Problem B from after the lecture was conducted. The average values have a percent difference of 12%. The variances are close to one another with a percent difference of 12.5%. Both the average and the variance values yield a similar percent difference. However, the p-value is 0.11 which is less than the significance level of 0.15. Thus, for this case, the effect of the two problems on the mean number of complete requirements generated may be considered statistically different.

5.3 Variety Validation

Variety represents how many overall requirements belonged to each category. The problems before are compared to each other and the problems after are compared. The values were plotted on two graphs (see Figure 5.1 and Figure 5.2), one comparing B1 to A1, while the other comparing B2 to A2. The category is represented on the x-axis and the percentage is on the y-axis. Each line represents a set of data (B1, A1 and B2, A2). Figure 5.1 represents a comparison of the two problems before lecture, while Figure 5.2 shows a comparison of the prompts after lecture.

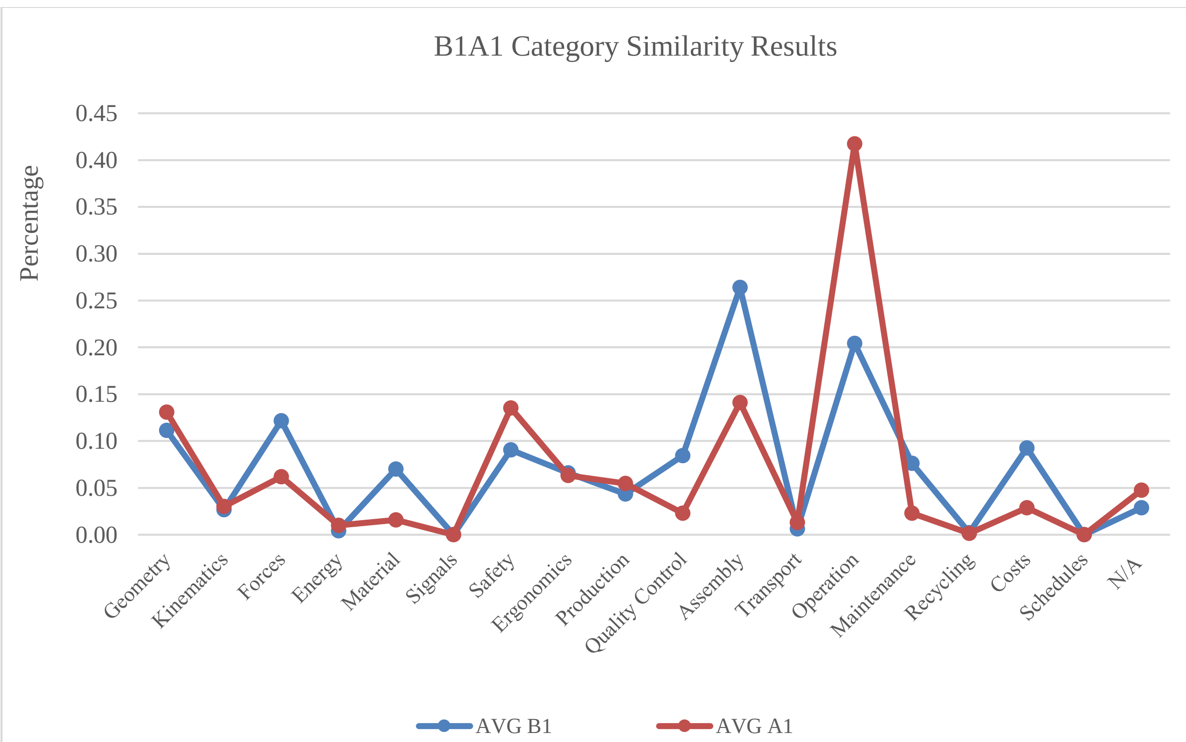


Figure 5.1. Problem Comparison Before Lecture

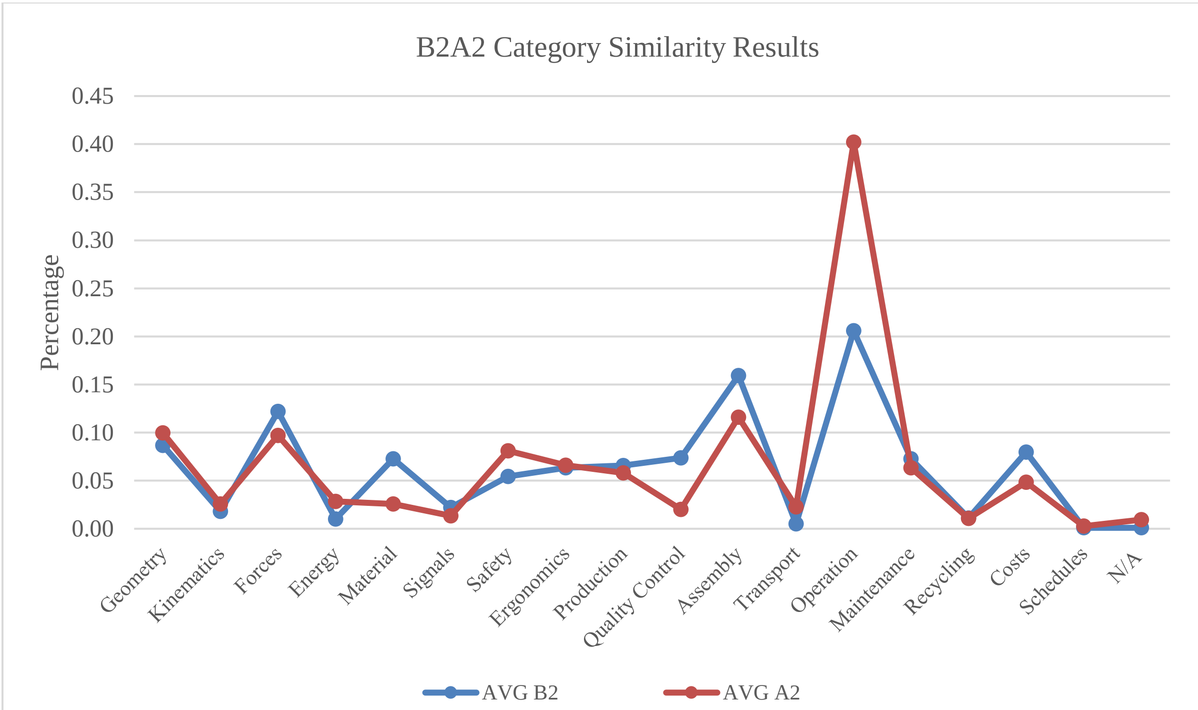


Figure 5.2. Problem Comparison After Lecture

As shown by Figure 5.1, A1 and B1 follow a similar pattern. The "Operation" and "Assembly" categories generated the highest values and the least overlap. This could mean that the two problems are formulated such that the focus of the devices is more prominent on these two categories. Problem A, the book picking problem, is more focused on the device's operation, while Problem B, the safety lock problem, could be formulated such that the focus is on the machine's assembly.

Similarly, Figure 5.2 also shows that the two given problems are similar due to their close values and pattern. "Operation" is once again the category with the least overlap and the greatest difference between the two values. This further reinforces that Problem A is formulated such that the focus of the device is mostly on its operation.

A further analysis is shown in Table 5.9 by examining the ranges between the two problems. These are compared between one another before the lecture (B1A1) and after the lecture (B2A2). Further, A1B2 compares the book picking problem given before the lecture to the safety lock problem given after the lecture. B1A2 compares the safety lock problem given before the lecture to the book picking problem given after the lecture.

Table 5.9. Problem Similarity Range for Requirement Variety

	B1A1	B2A2	A1B2	B1A2
Geometry	2%	1%	4%	1%
Kinematics	0%	1%	1%	0%
Forces	6%	2%	6%	2%
Energy	1%	2%	0%	2%
Material	5%	5%	6%	4%
Signals	0%	1%	2%	1%
Safety	4%	3%	8%	1%
Ergonomics	0%	0%	0%	0%
Production	1%	1%	1%	1%
Quality Control	6%	5%	5%	6%
Assembly	12%	4%	2%	15%
Transport	1%	2%	1%	2%
Operation	21%	20%	21%	20%
Maintenance	5%	1%	5%	1%
Recycling	0%	0%	1%	1%
Costs	6%	3%	5%	4%
Schedules	0%	0%	0%	0%
N/A	2%	1%	5%	2%

Table 5.9 shows low ranges across all categories except for the "Operation" category. Thus, the problems are similar with respect to all categories except for "Operation". In the case of B1A1 and B1A2, "Assembly" yields higher ranges compared to B2A2 and A1B2. This could mean that the way the two problems are formulated highlights more the "Operation" and "Assembly" aspects compared to all other categories.

5.4 Novelty Validation

Novelty represents the unique requirements based on their syntax and semantics. After a filtering process (see section 4.6.4), the unique requirements are shown in Table 5.10.

Table 5.10. Problem Similarity for Requirement Novelty

Code	Requirement
B2	Enclosed locking mechanism
B2	No user assembly
B2	Strong key material
B2	Option to locate key digitally
B2	Must be a U-shape with locking mechanisms on both ends
B2	Must have easy to use instruction manual
B2	Must be completed by xx date
A2	Ease of manufacturing, no complex tools or large time required
A2	Confirmation of loaded mechanism
A2	Non-complex shipping requirements
A2	Non-toxic materials used within production
A2	Reliably produced
A2	Must meet a deadline given by the customer

By examining the problem type and whether it was given before lecture or after lecture, the overall number of unique requirements in Problem A is almost equal to those in Problem B (6 for A and 7 for B). Since the numbers are roughly the same, the two problems can be determined to generate similar novel requirements. Further, the unique requirements were all generated after the students were trained on requirements. This will be discussed more in detail in section 6.4. In addition, for both problems, the number of unique requirements before lecture is equal to 0.

5.5 Summary of Problem Similarity Validation

Table 5.11 shows an overview of the post-hoc evaluation performed for each metric to observe the influence of the two problems on the requirements generated. It was found that for most metrics, the problems were not statistically different and produced similar requirements independent of the given problem. Therefore, the two problems will be assumed to be similar enough to allow for a fair comparison of before and after student performance.

Table 5.11. Problem Validation Results Overview

Metrics			**Problem Similarity**
Quantity	Count 1	Before	YES
		After	YES
	Count 2	Before	YES
		After	YES
	Count 3	Before	Maybe
		After	YES
Completeness		Before	YES
		After	Maybe
Variety		Before	YES
		After	YES
Novelty		Before	YES
		After	YES

Chapter Six
RESULTS: LECTURE INFLUENCE

The list of engineering requirements from before lecture and after lecture obtained from the experiment study were analyzed for an increase in number, completeness, varied, and novel requirements. The motivation for this analysis was the intellectual merit of understanding the effect of a lecture intervention on the students.

6.1 Quantity Intervention

The number of requirements generated by the students before the lecture were compared to those generated after the lecture. For the purpose of this analysis, Count 1 was examined to ensure similarity in the total number of responses, but was excluded here since the inclusion of statements that are either incomplete or not related to the problem did not contribute to the participant's understanding of the problem. Using Count 2 and Count 3, Problem B before lecture was compared to Problem A after the lecture, and Problem A before the lecture compared to Problem B after the lecture. The goal of this analysis is to determine whether the lecture influenced how the students generated requirements. It was hypothesized that the mean number of requirements generated before the lecture would be different to the number generated after the lecture. To test this claim, ANOVA was conducted between each of the cases against the null hypothesis shown below, with the significance level (α) set to equal 0.15.

$$H_o(\mu_a = \mu_b)$$

$$H_a(\mu_a \neq \mu_b)$$

As shown by Table 6.1, the mean number of requirements generated increased after students were given the lecture, regardless of which problem was received first, and regardless of which count was used. Furthermore, the p-values from the ANOVA tests between the groups were significantly less than 0.15, showing that there is not enough evidence to support the null hypothesis. Therefore, the alternative hypothesis that the mean number of requirements generated before and after the lecture are statistically different in every case is accepted.

Table 6.1. Effect of Intervention on Number of Requirements Generated

	Count 2								**Count 3**							
	B1A2		A1B2		A1A2		B1B2		B1A2		A1B2		A1A2		B1B2	
Mean	9.5	15	10	14	10	15	9.5	14	7	13	8	12	8	13	7	12
Variance	15	29	13	21	13	29	15	21	12	20	11	26	11	20	12	26
Observations	51	51	69	69	69	51	51	69	51	51	69	69	69	51	51	69
P-value	6.46E-11		5.22E-08		2.07E-07		4.22E-08		7.06E-16		5.40E-06		6.84E-09		2.19E-07	

Since the problems were deemed to be similar enough for a fair comparison (see section 5.1), an evaluation between all of the requirements before lecture compared to all requirements after lecture was performed (see Table 6.2), regardless of the problem. The p-value from the ANOVA test is significantly less than 0.15, showing that number of requirements generated before and after the lecture are statistically different. This means that the lecture had a positive influence on the number of requirements generated.

Table 6.2. Comparison of all Requirements from Before to all Requirements After Intervention

	Before (A1 + B1)	After (A2 + B2)
Average	7.7	12.0
Variance	11.6	23.2
Count	120	120
P-value	4.76E-14	

Further, an analysis of the percent increase in the number of requirements generated before and after the lecture with the same population number was performed. This is necessary to observe whether the requirements increased or decreased and by how much. The initial analysis revealed that there were a few outliers in the data. An outlier refers to one or more data points that are clearly separate from all other data points, as measured by a value either greater than the third quartile plus 1.5 times the interquartile range, or less than the first quartile minus 1.5 times the interquartile range [94]. Using this, four outliers for Count 2 and eight outliers for Count 3 were identified in the data and excluded from this analysis. The conclusion that can be drawn from Table 6.3 is that there is a clear increase in the number of requirements generated by students after the lecture when compared to the number of requirements generated before it.

Table 6.3. Percentage Increase in Number of Requirements Generated

B1A2		A1B2	
Count 2	Count 3	Count 2	Count 3
61.3%	74.2%	42.5%	44.4%

6.2 Completeness Intervention

The number of complete requirements generated by the students before the lecture is compared to those generated after the lecture. The requirements from Problem A before lecture are compared to Problem B after lecture, and Problem B before lecture is compared to Problem A after lecture. Further, Problem A before and Problem A after lecture are compared as well as Problem B before to Problem B after lecture (see Table 6.4). By looking at the average number of complete requirements for all four permutations, the mean increases except for B1B2 which instead decreases. The increase however is minimal. By observing the p-values, the lecture intervention did not have a statistically significant impact on B1A2, A1B2, and B1B2 since the values are greater than the significance level of 0.15. This could mean that there would be a need for a more targeted lecture specifically on how to write requirements. However, the value of 0.05 for A1A2 shows that the intervention did have a statistically significant impact, increasing the level of completeness of the requirements in this case. The averages are in the mid-low range with a maximum possible weight of 2.5 and a minimum of 0.

Table 6.4. Effect of Intervention on Requirement Completeness

	B1A2		A1B2		A1A2		B1B2	
Average	1.41	1.46	1.27	1.30	1.27	1.46	1.41	1.30
Variance	0.58	0.34	0.28	0.30	0.28	0.34	0.58	0.30
Observations	51	51	69	69	69	51	51	69
P-value	0.71		0.73		0.05		0.33	

6.3 Variety Intervention

First, to study how lecture intervention impacted the variety of the requirements produced, the categories are ranked according to their use frequency for each problem before and after lecture. Tables 6.5-6.8 show the ranking order starting from the most frequent to the less frequent. Shades of green (from dark to light) is used to visualize the most frequent to less frequent categories. Categories with a percentage greater than 15%

are represented with the darkest shade of green. The other groups are the categories in the medium-high range (8%-15%), medium-low range (2%-8%), and low range (<2%). The categories highlighted in red were not addressed by the students in their requirements.

Table 6.5. B1 Variety Ranking Order

B1		
A	Assembly	26.4%
B	Operation	20.4%
C	Forces	12.2%
D	Geometry	11.1%
E	Safety	9.3%
F	Costs	9.1%
G	Quality Control	8.5%
H	Maintenance	7.6%
I	Material	7.0%
J	Ergonomics	6.6%
K	Production	4.3%
L	Kinematics	2.9%
M	N/A	2.7%
N	Transport	0.6%
O	Recycling	0.4%
P	Energy	0.2%
Q	Signals	0.0%
R	Schedules	0.0%

Table 6.6. A1 Variety Ranking Order

A1		
B	Operation	41.7%
A	Assembly	14.1%
E	Safety	13.5%
D	Geometry	13.1%
C	Forces	6.3%
J	Ergonomics	6.2%
K	Production	5.5%
M	N/A	4.7%
L	Kinematics	3.0%
F	Costs	2.9%
G	Quality Control	2.3%
I	Material	2.3%
H	Maintenance	1.6%
N	Transport	1.3%
P	Energy	1.0%
O	Recycling	0.1%
Q	Signals	0.0%
R	Schedules	0.0%

In Table 6.5, most requirements belonged to the "Assembly" category. The next most frequent requirement pertained to the "Operation" or functionality of the device. The "Signals" and "Schedules" categories were not addressed in any requirement by the participants.

In Table 6.6, requirements address "Operation" more than "Assembly". However, similarly to Table 6.5, they do not address the "Signals" and "Schedules" categories.

Table 6.7. B2 Variety Ranking Order

B2		
B	Operation	20.6%
A	Assembly	15.9%
C	Forces	12.2%
D	Geometry	8.7%
F	Costs	8.0%
I	Material	7.4%
K	Production	7.3%
G	Quality Control	7.3%
H	Maintenance	6.6%
J	Ergonomics	6.4%
E	Safety	5.4%
Q	Signals	2.2%
L	Kinematics	1.8%
P	Energy	1.1%
N	Transport	1.0%
O	Recycling	0.5%
M	N/A	0.1%
R	Schedules	0.1%

Table 6.8. A2 Variety Ranking Order

A2		
B	Operation	40.2%
A	Assembly	11.6%
C	Forces	10.0%
D	Geometry	9.7%
E	Safety	8.1%
J	Ergonomics	6.6%
K	Production	6.3%
H	Maintenance	5.8%
F	Costs	4.9%
L	Kinematics	2.8%
P	Energy	2.6%
I	Material	2.6%
G	Quality Control	2.3%
N	Transport	2.0%
Q	Signals	1.3%
O	Recycling	1.1%
M	N/A	0.9%
R	Schedules	0.3%

In both Table 6.7 and Table 6.8, "Operation" and "Assembly" are the categories covered by the most requirements. However, the requirements cover all categories. There is no category with 0% which means that, even if in a small amount, all categories were addressed after the participants were trained on requirements. This shows a greater variation compared to the requirements generated before the lecture.

The lecture positively affected the variety of requirements since more categories were covered after the intervention of the lecture. Further, the most common categories were “Operation” and “Assembly”. This is consistent with the results found from the similarity between the two problems. In addition, the percentage of the “N/A” category significantly decreased from before lecture to after lecture. This shows that the students had a clearer mind on how to address the requirements.

6.4 Novelty Intervention

The lecture had a positive influence on the level of unique requirements generated. Table 6.9 shows requirements that were deemed to not be unique in the last stage of the filtering process (see Figure 4.2). The requirements were excluded based on semantics, since other similar requirements existed with a different syntax but same content. The first two columns show the requirements along with the problem it belonged to and whether it was generated before or after lecture. The third column shows examples of other similar requirements that students generated. The fourth column gives a justification for the requirement not being unique.

Table 6.9. Non-Unique Requirements and Why

Code	Requirement	Similar Requirements	Justification
B2	Geometrically simple	The device should be a **simple geometry** **Simple** design Production ease, parts are of **simple geometry**	Stem words are repeated.
B2	Signals the user when successfully locked	Must **signal** user when property **locked** Must clearly **signal** to user that lock is indeed **locked** **Signal**: allow user to know when **locked**	Other participants generated the same requirement semantic, but with different wording.
A2	Fixed mounting to shelves	Must be a **mounted** design attached to the bookshelf **Mount** to most bookcases It must be permanently **mounted**	Other participants generated the same requirement semantic, but with different wording.
A2	Operated from low area	Should be **operable** from wheelchair **height** Must be **operable** from wheelchair user **height** **Operating** handle at wheelchair **height**	"low area" is intended as height. Other participants generated requirements that addressed height.
A2	Shipped in small containers in multiple parts	Must be reasonable to **package** for **shipping** Come in small **package** so many can be **shipped** at once Must fit on a standard US pallet for **shipping**	"Shipped" and "containers" are the two key words. Other participants generated the same requirements with the same content but different syntax.
B2	Material properties to prevent theft	**Theft** resistant Must prevent **theft** Be strong enough to deter **theft**	This requirement addresses how to prevent "theft". Other participants addressed this same requirement.
B2	Made of Carbon Steel	Durable, long-lasting **metal** of some sort Must be made of a sturdy **metal** Made of **metal**	Different level of abstraction but same requirement. Carbon Steel is a metal.

As shown in Table 6.10, all the novel requirements come from after the lecture was given to the students (A2 and B2). No unique requirement was generated before the lecture. This shows that the students started thinking differently and more innovatively after they had been trained on requirements. Thus, the lecture inspired the students to identify more unique requirements. Table 6.10 shows the unique requirements that remained after following the filtering process.

Table 6.10. Unique Requirements

Code	Requirement
B2	Enclosed locking mechanism
B2	No user assembly
B2	Strong key material
B2	Option to locate key digitally
B2	Must be a Ushape with locking mechanisms on both ends
B2	Must have easy to use instruction manual
B2	Must be completed by xx date
A2	Ease of manufacturing, no complex tools or large time required
A2	Confirmation of loaded mechanism
A2	Non-complex shipping requirements
A2	Non-toxic materials used within production
A2	Reliably produced
A2	Must meet a deadline given by the customer

Chapter Seven
NOVICE VS. PRACTITIONER

While the primary aim of this study was to explore intervention impact, a secondary study was done to see if novice and practitioners perform similarly. This study addresses the following research questions:

RQ1. How do novices *without* training differ from practitioners in the quantity of requirements generated?

RQ2. How do novices *with* training differ from practitioners in the quantity of requirements generated?

7.1 Experiment

The aim of this experiment was to determine if there is a difference between practitioner and novice engineers in generating requirements. A practitioner is defined in this study as three years or more of uninterrupted full-time work in engineering activities in a company.

7.2 Participants

The experiment was run with two populations. The first population consisted of six practitioners at an engineering and construction company in Greenville, SC. The practitioners are all electrical engineers that worked uninterruptedly at a company in engineering activities for more than three years. Only one of the practitioner participants had a graduate education. They all had experience with defining engineering requirements for a project. However, four of the participants reported never taking a class on engineering requirements. The second population consisted of four practitioners from an automation company in Greenville, SC. The practitioners are all mechanical engineers that worked uninterruptedly in engineering activities for more than three years. Two of them had a graduate education. A summary table of the survey conducted on their prior experience is shown in Table 7.1.

Table 7.1. Level of Experience Practitioner Survey

Questions	Participants from First Population						Participants from Second Population			
	A	B	C	D	E	F	A	B	C	D
What was your B.S Major?	E.E.	E.E.	E. E. Tech.	E.E.	E.E.	E.E.	M.E.	M.E.	M.E.	N/A
Did you have any Graduate Education?	Yes	No	No	No	No	No	Yes	No	Yes	No
If yes, what was your M.S./PhD major?	Math Edu.	N/A	N/A	N/A	N/A	N/A	M.E.	N/A	M.B.A.	N/A
In what year did you complete your most recent degree?	2013	1980	1986	2011	1981	2002	2012	2016	1979	N/A
How many years of uninterrupted full-time work in engineering activities have you had?	14	38	32	7	38	13	>3	>3	>3	>3
Have you had any experience with defining requirements for an engineering related project?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A
Have you ever had training or a class on engineering requirements?	Yes	Work Contact	No	No	Yes	No	Yes	Yes	N/A	N/A

7.3 Execution

The main purpose for going to the two companies was to conduct a different experiment on automation. However, before running the automation experiment, the participants were told that they were going to start with an activity on engineering requirements to take their mind off their everyday work (for the full list of requirements please see Appendix G). The participants were then given the experiment packet with Problem A and were given 10 minutes to complete it. At the end of the activity, the survey on their experience level was collected (see Table 7.1).

7.4 Results

Given Problem A, the results show that the practitioners and the students (novices) without training (before lecture) generate roughly the same number of requirements. Using Count 2 and Count 3, the number of requirements generated by the novices for Problem A before and after the lecture (A1 and A2) were compared to the requirements generated by the practitioners (A(P)) (to look at the results for each count please see Appendix H). It was hypothesized that the practitioners would generate more requirements than the novice before the lecture. Further, it is also expected that the practitioners would generate more requirements than the novices with the 50-minute lecture intervention. To test this, ANOVA was used against the null hypothesis with a significance level equal to 0.15.

As shown by Table 7.2, for Count 2 the practitioners averaged 7.8 requirements which is less than the average generated by the novices before lecture of 10.1. In addition, the p-value between the groups was less than 0.15, showing that the novice and the practitioners generated a different number of requirements. The minimum number of requirements generated by the practitioners was six and the maximum was eleven. For the novices, the minimum was four and the maximum was nineteen.

Table 7.2. ANOVA Test Count 2 comparing A1 vs. A(P)

Groups	*Count*	*Sum*	*Average*	*Variance*	*P-value*
Practitioner	10	78	7.8	2.4	0.06
Novice Before	69	696	10.1	13.3	

However, for Count 3, by examining the completeness of the requirements, students before the intervention generated typically less complete requirements with an implied subject and a verb. Practitioners included an implied subject and verb in all their requirements. Thus, the practitioners generated an average of 7.8 complete requirements (see Table 7.3), which is close to the student without prior training after filtering value of 8.2. Furthermore, the p-value is high, showing that the practitioners' number of requirements are equal to the students'. Therefore, the practitioners perform similarly to the novices without the intervention when considering complete requirements.

Table 7.3. ANOVA Test Count 3 comparing A1 vs. A(P)

Groups	*Count*	*Sum*	*Average*	*Variance*	*P-value*
Novice Before	69	565	8.2	10.7	0.71
Practitioner	10	78	7.8	2.4	

As shown by Table 7.4, Count 2 and Count 3 for the novices before lecture are different. This is shown by the low p-value of 0.002. This could explain the difference in the results when comparing the practitioners to Count 2 and to Count 3. Count 3 shows that the number of requirements generated are similar, while Count 2 shows that they are different. The more reliable count is Count 3 because it gives a minimum viable definition for the sentence to be a requirement by including an implicit subject and an explicit verb. For this experiment, Count 3 will be considered as the truer result.

Table 7.4. Comparing A1 Novices for Count 2 and Count 3

Novice	*Count*	*Sum*	*Average*	*Variance*	*P-value*
Count 2 Before	69	696	10	13.3	0.002
Count 3 Before	69	565	8.2	10.7	

From Table 7.5 and Table 7.6, the p-values from the ANOVA tests between the groups were less than 0.15, showing that the practitioners and students after lecture performed at different levels. The students after receiving training on engineering requirements generated more requirements than the practitioners (see Table 7.5). In Count 3 in which the requirements were tested for completeness, the students still generated more complete requirements than the practitioners (see Table 7.6).

Table 7.5. ANOVA Test Count 2 comparing A2 vs. A(P)

Groups	*Count*	*Sum*	*Average*	*Variance*	*P-value*
Novice After	51	746	14.6	28.7	0.0002
Practitioner	10	78	7.8	2.4	

Table 7.6. ANOVA Test Count 3 comparing A2 vs. A(P)

Groups	*Count*	*Sum*	*Average*	*Variance*	*P-value*
Novice After	51	641	12.6	19.5	0.0014
Practitioner	10	78	7.8	2.4	

By considering only Count 3, the findings from the practitioner versus student experiment shows that the practitioners are similar to the novice without training. Further, practitioners generated fewer requirements than novice with training. This is summarized in Figure 7.1.

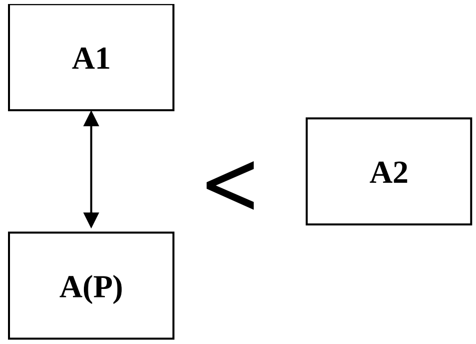


Figure 7.1 Count 3 Practitioner vs. Novice Result

7.5 Summary of Practitioner vs. Novice Findings

In this experiment it was found that the requirements generated by the practitioners were the same as the requirements generated by the novice before training, in terms of quantity. Further, it was found that the novice with training generated more requirements than the practitioners. This serves as a baseline for future work with a larger population of practitioners. Further, it provides academia with a justification to use untrained students as a surrogate population for practitioners when studying requirements generation. Finally, additional studies could be conducted following this approach to create baselines against practitioner performance for other engineering design activities and tasks. This is discussed in Chapter Nine.

Chapter Eight
CONCLUSIONS

The main objective of this research is to understand the effects of lecture intervention on the quantity, quality (completeness), variety, and novelty of requirements generated. To achieve this goal, a controlled experiment was conducted with fourth year undergraduate mechanical engineering students in a design methods course within the Department of Mechanical Engineering at Clemson University. The class was randomly divided into two groups, but students worked independently. The first group received Problem A before lecture and Problem B after the lecture. The second group received Problem B before lecture and Problem B after lecture. The students were prompted to generate a list of engineering requirements based on the given problem statement. The solutions were coded per participant for quantity and completeness and per requirement for variety and novelty. The data was then analyzed to answer the research and methodological questions.

8.1 Research Findings

There were four research questions and four methodological questions addressed in this research. The research questions address the impact of a lecture intervention on the students. The methodological questions address the design problems used for the experiment to verify that they prompted students to generate requirements in a similar way.

8.1.1 Problem Similarity Findings

The two design problems given to students were compared before the experiment and were deemed similar enough to produce the same expected result in the post-hoc validation analysis. This section seeks to answer the methodological questions given in section 4.1.

MQ1. Are the two problems given to the students the same with respect to quantity?

Problem A and Problem B for quantity did not have a different effect on the requirements generated. They were not found to result in significant differences in five of the six ANOVA tests. It is concluded that the problems are similar enough to allow for a fair comparison of before and after intervention performance using the two problems.

MQ2. Are the two problems given to the students the same with respect to completeness?

The problems were not found to result in significant differences in one of the two ANOVA tests. The values before lecture yielded a p-value higher than the significance level, resulting in the problems not being statistically different. However, the p-value for after lecture was lower than the significance level, resulting in the two problems being statistically different. Thus, the problem comparison for completeness did not have a different effect on the requirements generated before lecture.

MQ3. Are the two problems given to the students the same with respect to variety?

Results for variety showed a similar trend among all categories except for assembly and operation. Results did show that the two problems might have been formulated such that the assembly and operation of the device was more critical than other categories since these categories yielded higher values.

MQ4. Are the two problems given to the students the same with respect to novelty?

Results for novelty showed that the two problems had a similar effect. No novel requirements emerged from either Problem A or Problem B from before the lecture. However, a similar number of novel requirements did emerge from Problem A and Problem B after lecture. Thus, the problems for novelty did not have a different effect on the requirements generated.

8.1.2 Lecture Intervention Findings

A summary of the results found for the impact that the lecture had on the students is described by addressing the research questions outlined in Chapter One.

RQ1. How does lecture intervention impact the quantity of the requirements generated?

The initial hypothesis was that the participants would generate more requirements after the lecture. The participants generated significantly more requirements in the activity performed after the lecture, regardless of the order in which the students received the problems. From these conclusions, one can infer that the lecture on requirements had a positive influence on how the students generated requirements for a given design problem.

RQ2. How does lecture intervention impact the completeness of the requirements generated?

The lecture had little impact on the completeness of the requirements generated. The level of completeness changed significantly only for Problem A before to Problem A after lecture. For all other cases, the change was not significant.

RQ3. How does lecture intervention impact the variety of the requirements generated?

Participants generated more varied requirements after the lecture. Students did not cover all categories before the lecture but did incorporate all categories after the lecture. The categories that were addressed the most were "Assembly" and "Operation". Thus, the lecture influenced the variety of the requirements generated by the students for a given engineering design problem since more varied requirements were generated after the lecture was given to the students.

RQ4. How does lecture intervention impact the novelty of the requirements generated?

Novel requirements were generated only after the lecture was given to the students. After the lecture, students generated more unique requirements. Thus, it can be concluded that the lecture helped a few participants think innovatively.

It can be noted that the lecture can be mapped to each of these measures (quantity, completeness, novelty, and variety). During the lecture, the professor emphasized having many requirements to address engineering problems. This addressed the quantity measure. The Kano Diagram could have influenced the novelty of the students, while the Requirement Checklist had an impact on the variety of requirements generated. The professor did show examples of what a requirement should include in terms of completeness, but this was not clearly emphasized in terms of its grammar. The professor did not address how to write a requirement. Thus, by mapping the lecture to the measures, a direct overlap can be seen with quantity, novelty, and variety, however not with completeness.

8.1.3 Practitioner vs. Novice Findings

A summary on the results found for the second experiment comparing novices to practitioners is described. The research questions addressed in Chapter Seven are addressed.

RQ1. How do novices without training differ from practitioners in the quantity of requirements generated?

For Count 2, it was found that the novices before training and practitioners generated a different number of requirements with a p value of 0.06. However, when running the data analysis with the more reliable source which is Count 3, it was found that practitioners generated the same number of requirements as the novices before training with a p-value equal to 0.71.

RQ2. How do novices with training differ from practitioners in the quantity of requirements generated?

For both Count 2 and Count 3, novices with training generated more requirements than the practitioners. This is shown by the significantly low p-values of 0.0002 and 0.0014 found.

8.2 Research Limitations

This study was limited to mechanical engineering students presented with simple design prompts. Another limitation of the study was that, by using LSA and the filtering process to identify the unique requirements, there could be some more unique requirements that did not emerge from this method. In addition, the level of completeness could have been weighted differently.

Chapter Nine
FUTURE WORK

Future work should concentrate on conducting the same experiment with practitioner engineers that work in industry and compare the data between the students and the practitioners. Research questions for this type of study are the following:

RQ1. How do novices *without* training differ from practitioners in the **quality** of requirements generated?

RQ2. How do novices *without* training differ from practitioners in the **variety** of requirements generated?

RQ3. How do novices *without* training differ from practitioners in the **novelty** of requirements generated?

RQ4. How do novices *with* training differ from practitioners in the **quality** of requirements generated?

RQ5. How do novices *with* training differ from practitioners in the **variety** of requirements generated?

RQ6. How do novices *with* training differ from practitioners in the **novelty** of requirements generated?

These research questions are of interest to bridge the gap between academia and industry. They could serve as a reason for academia to equate the performance of experiments done with students, without significant training, to practitioners.

Future work could also lie in exploring this setting within teams. Another possible research question could be:

RQ. How does the teamwork of novice engineers differ from that of practitioner engineers?

Most of the research that has been done is focused on the behavior or visual analogical reasoning of the practitioner and novice as individuals. Little research has been done on observing their behavior in a team setting. In addition, existing research uses visual protocol analysis and interviews by observing how they solve a problem or given task. For this future potential research, the aim would be to observe how engineering design practitioner and novice teams would behave in producing requirements using a "think aloud" protocol study to compare their team interaction. Thus, similarities and differences among practitioner and novice teams using requirements is a research gap that has not yet been addressed. This can help academia improve upon their capstone senior design teams and industries in making more efficient teams.

Finally, this research could also be addressed by observing the difference between the functional and non-functional requirements generated and how these may impact quantity, quality, variety, and novelty. Possible research questions could be:

RQ1. How does lecture intervention impact the quantity, quality, variety, and novelty of *functional* requirements generated?

RQ2. How does lecture intervention impact the quantity, quality, variety, and novelty of *non-functional* requirements generated?

Preliminary analysis and data results to address this functional and non-functional requirement future work are shown in Appendix I.

REFERENCES

[1] Pahl G., Beitz W., Feldhusen J., and Grote K.-H., 2007, *Engineering Design*, Springer London, London.

[2] Hyman B., 2003, *Fundamentals of Engineering Design*.

[3] Ullman D. G., 2013, *The Mechanical Design Process*.

[4] Otto K. N., and Wood K. L., 1998, “Product Evolution: A Reverse Engineering and Redesign Methodology,” *Res. Eng. Des.*, **10**(4), pp. 226–243.

[5] KOEN B. V., 1994, “Toward a Strategy for Teaching Engineering Design,” *J. Eng. Educ.*, **83**(3), pp. 193–201.

[6] Rosé C. P., Gweon G., Arguello J., Finger S., Smailagic A., and Siewiorek D. P., 2007, “Towards an Interactive Assessment Framework for Engineering Design Learning,” *Volume 3: 19th International Conference on Design Theory and Methodology; 1st International Conference on Micro- and Nanosystems; and 9th International Conference on Advanced Vehicle Tire Technologies, Parts A and B*, ASME, pp. 45–54.

[7] Telenko C., Camburn B., Hölttä-Otto K., Wood K., and Otto K., 2014, “Designettes: New approaches to multidisciplinary engineering design education,” *Proceedings of the ASME Design Engineering Technical Conference*.

[8] Masi B. A., 2003, “The Impact of Faculty-Mentored Versus Web-Guided Engineering Design Experience on Freshman Skills,” *American Society for Engineering Education*, pp. 1–8.

[9] Turner C., and Agyemang M., 2017, “Underlying design motivations in design methods and outcomes,” *International Conference on Engineering Design*, pp. 469–478.

[10] Linnerud B., and Mocko G., 2013, “Factors That Effect Motivation and Performance on Innovative Design Projects,” *Volume 1: 15th International Conference on Advanced Vehicle Technologies; 10th International Conference on Design Education; 7th International Conference on Micro- and Nanosystems*, ASME, p. V001T04A019.

[11] Helm K. C., Jablokow K. W., McKilligan S., Silk E. M., and Daly S., 2016, “Evaluating the impacts on different interventions on quality in concept generation,” *American Society of Engineering Education*, pp. 1–17.

[12] Fadel G., 2000, *Multi-national around the clock collaborative senior design project*.

[13] Abe T., and Starr P., 2003, “Teaching the writing and role of specifications via a structured teardown process,” *Des. Stud.*, **24**(6), pp. 475–489.

[14] Joshi S., Summers J. D., and Mocko G. M., 2012, “Requirements in Engineering Design: What are we teaching?,” *Proceedings of the TMCE 2012*, pp. 1–8.

[15] Worinkeng E., Joshi S., and Summers J. D., 2015, “An experimental study: analyzing requirement type influence on novelty and variety of generated solutions,” *Int. J. Des. Creat. Innov.*, **3**(2), pp. 61–77.

[16] Thulasiram E., 2007, “Modeling Requirements Propagation to Generate Solutions

for Minimizing Mass," Clemson University.
[17] Maier J. R. A., Ezhilan T., and Fadel G. M., 2009, "The Affordance Structure Matrix: A Concept Exploration and Attention Directing Tool for Affordance Based Design."
[18] Maier J. R., Ezhilan T., Fadel G. M., Summers J., and Mocko G., 2007, "A hierarchical requirements modeling scheme to support engineering innovation," ... *Conf. Eng. ….*
[19] Lamar C., 2009, "Linguistic Analysis of Natural Language Engineering Requirements," Clemson University.
[20] Lamar C., and Mocko G. M., 2010, "Linguistic analysis of natural language engineering requirement statements," *Proceedings of the 8th International Symposium on Tools and Methods of Competitive Engineering, TMCE 2010*, I. Horvath, ed., Ancona, Italy.
[21] Joshi S., 2010, "Mapping Problem and Requirements to Solution: Document Analysis os Senior Design Projects," Clemson University.
[22] Joshi S., and Summers J. D., 2010, "Investigating information loss in collaborative design: a case study with capstone design project," *National Capstone Conf.*
[23] McLellan J. M., 2010, "A Proposed Method to Identify Requirements Significant to Mass Reduction," Clemson University.
[24] Mclellan J., Maier J., Fadel G., and Mocko G., 2009, "A method for identifying requirements critical to mass reduction using DSMs and DMMs," *DSM'09*.
[25] Mclellan J. M., Maier J. R. A., Fadel G. M., and Mocko G. M., 2009, "Generating Design Structure Matrices and Domain Mapping Matrices using SysML," *11th International Design Structure Matrix Conference, DSM09*.
[26] Morkos B., 2012, "Computational Representation and Reasoning Support for Requirements Change Management in Complex System Design," Clemson University.
[27] Shankar P., 2011, "Development of a Design Method to Reduce Change Propagation Effects," Clemson University.
[28] Shankar P., Morkos B., and Summers J. D., 2012, "Reasons for change propagation: A case study in an automotive OEM," *Res. Eng. Des.*
[29] Morkos B., Shankar P., and Summers J. D., 2012, "Predicting requirement change propagation, using higher order design structure matrices: an industry case study," *J. Eng. Des.*
[30] Morkos B., and Summers J. D., 2011, "Requirement Change Propagation Prediction Approach: Results From an Industry Case Study."
[31] Joshi S., 2013, "Understanding the role of requirements in engineering design by novices," Clemson University.
[32] Summers J. D., Joshi S., and Morkos B., 2014, "Requirements Evolution: Relating Functional and Non-Functional Requirement Change on Student Project Success," *Volume 3: 16th International Conference on Advanced Vehicle Technologies; 11th International Conference on Design Education; 7th Frontiers in Biomedical Devices*, ASME, p. V003T04A002.

[33] Worinkeng E., 2013, "Analyzing Requirement Type Influence on Generated Solutions," Clemson University.
[34] Lash A., 2013, "Computational Representation of Linguistic Semantics for Requirement Analysis in Engineering Design," Clemson University.
[35] Lash A., Murray K., and Mocko G., 2013, "Natural Language Processing Applications in Requirements Engineering."
[36] DelSpina B., 2017, "Requirement Culture at a Large Scale Medical Device Developer," Clemson University.
[37] DelSpina B., Gilliam S., Summers J., and Morkos B., 2018, "Corporate requirement culture in development of a large scale medical system: A case study," *Proceedings of International Design Conference, DESIGN*.
[38] Effendi I., Henson B., Agouridas V., and de Pennington A., 2002, "Methods and Tools for Requirements Engineering of Made-to-Order Mechanical Products," *International Conference on Engineering Design*, pp. 151–160.
[39] Johansson O., and Krus P., 2008, "Configurable Design Matrixes for Systems Engineering Applications."
[40] Fernandes R., Grosse I., Krishnamurty S., and Wileden J., 2009, "Design and Innovative Methodologies in a Semantic Framework."
[41] Matthews J., Ding L., Feldman J., and Mullineux G., 2009, "The Maintenance and Handling of Constraints in Machine Design," *Volume 2: 29th Computers and Information in Engineering Conference, Parts A and B*, ASME, pp. 443–452.
[42] Geng X., Chu X., Xue D., and Zhang Z., 2011, "Prioritizing Engineering Characteristics of Product-Service System Using Analytic Network Process and Data Envelopment Analysis."
[43] Bryden K. M., and Johnson N. G., 2012, "Understanding Rural Village Energy Needs and Design Constraints."
[44] Lim H. W., Goh K. H., and Lu W. F., 2012, "Best Practices for Engineering Design Project in Undergraduate Student Education With Eco-Friendly Vehicle Design," *Volume 7: 9th International Conference on Design Education; 24th International Conference on Design Theory and Methodology*, ASME, p. 13.
[45] Joshi S., and Summers J. D., 2015, "Requirements evolution: Understanding the type of changes in the requirement document of novice designers," *ICoRD'15 – Research into Design Across Boundaries Volume 2*, Springer London, Bangalore, India, p. pp 471-481.
[46] Sen C., Mukhopadhyay A., Fields J., and Ameri F., 2015, "An Approach for Measuring Information Content of Textual Engineering Requirements Using a Form-Neutral Representation."
[47] Joshi S., and Summers J. D., 2015, "Tracking Project Health Using Completeness and Specificity of Requirements: A Case Study."
[48] C Haskins K. F., 2011, *International Council on Systems Engineering. Systems Engineering Handbook: A Guide for System Life Cycle Processes and Activities.*
[49] Norman D., and Draper S., 1986, *User Centered Systems Design*.
[50] Leonard D., Rayport J. F., Courtney H., Kirkland J., and Markides C. C., 1997, "Spark Innovation Through Empathetic Design," *Harv. Bus. Rev.*, pp. 102–113.

[51] Hochster A., Brown E. K., and Miller J. E., 2006, “Syntax: A Linguistic Introduction to Sentence Structure,” *Language (Baltim).*
[52] Ulrich K. T., and Eppinger S. D., 2012, *Product Design and Development: Fifth Edition*.
[53] Dym C. L., and Brown D. C., 2012, *Engineering Design*.
[54] Mylopoulos J., Chung L., and Nixon B., 1992, “Representing and Using Nonfunctional Requirements: A Process-Oriented Approach,” *IEEE Trans. Softw. Eng.*
[55] Kotonya G., and Sommerville I., 1998, “Requirements Engineering : Processes and Techniques (Worldwide Series in Computer Science),” *Star*.
[56] Maier J. R. A., Fadel G. M., and Battisto D. G., 2009, “An affordance-based approach to architectural theory, design, and practice,” *Des. Stud.*
[57] Shah J. J., Smith S. M., and Vargas-Hernandez N., 2003, “Metrics for measuring ideation effectiveness,” *Des. Stud.*, **24**(2), pp. 111–134.
[58] Peeters J., Verhaegen P. A., Vandevenne D., and Duflou J. R., 2010, “Refined Metrics for Measuring Novelty in Ideation,” *Proc. IDMME - Virtual Concept 2010*, pp. 1–4.
[59] Brown D. C., 2014, “Problems with the Calculation of Novelty Metrics 2 . The Base Methods,” pp. 1–9.
[60] Nelson B. A., Wilson J. O., Rosen D., and Yen J., 2009, “Refined metrics for measuring ideation effectiveness,” *Des. Stud.*, **30**(6), pp. 737–743.
[61] Charyton C., Ivcevic Z., Plucker J. A., and Kaufman J. C., 2009, “Creativity Assessment in Higher Education,” *Handbook of Research on Assessment Technologies, Methods, and Applications in Higher Education*, IGI Global, pp. 78–96.
[62] Goel V., and Pirolli P., 1992, “The structure of Design Problem Spaces,” *Cogn. Sci.*, **16**(3), pp. 395–429.
[63] Dorst K., and Cross N., 2001, “Creativity in the design process: co-evolution of problem–solution,” *Des. Stud.*, **22**(5), pp. 425–437.
[64] Linsey J. S., Green M. G., Murphy J. T., Wood K. L., and Markman A. B., 2005, “‘Collaborating To Success’: An Experimental Study of Group Idea Generation Techniques,” *Volume 5a: 17th International Conference on Design Theory and Methodology*, ASME, pp. 277–290.
[65] Kumar V., and Mocko G., 2016, “Similarity of Engineering Design Problems to Enable Reuse in Design Research Experiments,” *Volume 7: 28th International Conference on Design Theory and Methodology*, ASME, p. V007T06A042.
[66] Durand F., Helms M. E., Tsenn J., McAdams D. A., and Linsey J. S., 2015, “In Search of Effective Design Problems for Design Research,” *Volume 7: 27th International Conference on Design Theory and Methodology*, ASME, p. V007T06A011.
[67] Levy B., Hilton E., Tomko M., and Linsey J., 2017, “Investigating Problem Similarity Through Study of Between-Subject and Within-Subject Experiments,” *Volume 7: 29th International Conference on Design Theory and Methodology*, ASME, p. V007T06A012.

[68] Summers J. D., and Shah J. J., 2010, “Mechanical Engineering Design Complexity Metrics: Size, Coupling, and Solvability,” *J. Mech. Des.*, **132**(2), p. 021004.
[69] Dorst K., 2003, “The problem of design problems,” *Expert. Des.*, pp. 135–147.
[70] Chawla A., and Summers J. D., 2018, “Function Ordering Within Morphological Charts: An Experimental Study,” *Volume 7: 30th International Conference on Design Theory and Methodology*, ASME, p. V007T06A012.
[71] Patel A., Kramer W., Summers J. D., and Shuffler-Porter M., 2016, “Function Modeling: A Study of Sequential Model Completion Based on Count and Chaining of Functions,” *Volume 7: 28th International Conference on Design Theory and Methodology*.
[72] Richardson III J. L., Summers J. D., and Mocko G. M., 2011, “Function Representations in Morphological Charts: An Experimental Study on Variety and Novelty on Means Generated,” *Interdiscip. Des. Proc. 21st CIRP Des. Conf.*
[73] CARDOSO C., and BADKE-SCHAUB P., 2011, “The Influence of Different Pictorial Representations During Idea Generation,” *J. Creat. Behav.*, **45**(2), pp. 130–146.
[74] Linsey J. S., Clauss E. F., Kurtoglu T., Murphy J. T., Wood K. L., and Markman A. B., 2011, “An Experimental Study of Group Idea Generation Techniques: Understanding the Roles of Idea Representation and Viewing Methods,” *J. Mech. Des.*, **133**(3), p. 031008.
[75] Fu K., Cagan J., and Kotovsky K., 2010, “Design Team Convergence: The Influence of Example Solution Quality,” *J. Mech. Des.*, **132**(11), p. 111005.
[76] Linsey J. S., Wood K. L., and Markman A. B., 2008, “Increasing Innovation: Presentation and Evaluation of the Wordtree Design-by-Analogy Method,” *Volume 4: 20th International Conference on Design Theory and Methodology; Second International Conference on Micro- and Nanosystems*, ASME, pp. 21–32.
[77] Goldschmidt G., and Smolkov M., 2006, “Variances in the impact of visual stimuli on design problem solving performance,” *Des. Stud.*, **27**(5), pp. 549–569.
[78] Smith G., Troy T. J., and Summers J. D., 2006, “Concept Exploration Through Morphological Charts: An Experimental Study,” *Volume 4a: 18th International Conference on Design Theory and Methodology*.
[79] McKoy F. L., Vargas-Hernández N., Summers J. D., and Shah J. J., 2001, “Influence of Design Representation on Effectiveness of Idea Generation,” *Des. Eng. Tech. Conf. Comput. Inf. Eng. Conf.*
[80] Jansson D. G., and Smith S. M., 1991, “Design fixation,” **12**(1), pp. 3–11.
[81] Joshi S., and Summers J. D., 2014, “Impact of Requirements Elicitation Activity on Idea Generation: A Designer Study,” *Vol. 7 2nd Bienn. Int. Conf. Dyn. Des. 26th Int. Conf. Des. Theory Methodol.*, p. V007T07A026.
[82] Shah J. J., Smith S. M., and Vargas-Hernández N., 2003, “Metrics for Measuring Ideation Effectiveness,” *Des. Stud.*, **24**, pp. 111–134.
[83] Patel A., Elena M. V., and Summers J. D., 2019, “A Systematic Approach to Evaluating Design Prompts in Supporting Experimental Design Research,” *ICED19 22nd International Conference on Engineering Design*.

[84] Worinkeng E., and Summers J. D., 2014, “Analyzing Requirement Type Influence on Concept Quality and Quantity During Idation : an Experimental Study,” pp. 1–10.

[85] Viswanathan V. K., and Linsey J. S., 2012, “Physical Models and Design Thinking: A Study of Functionality, Novelty and Variety of Ideas,” *J. Mech. Des.*, **134**(9), p. 091004.

[86] Linsey J. S., Wood K. L., and Markman A. B., 2008, “Increasing Innovation: Presentation and evaluation of the wordtree design-by-analogy method,” *Proc. ASME 2008 Int. Des. Eng. Tech. Conf. Comput. Inf. Eng. Conf. IDETC/CIE*.

[87] Smith G., Troy T. J., and Summers J. D., 2006, “Concept Exploration Through Morphological Charts: An Experimental Study,” *Volume 4a: 18th International Conference on Design Theory and Methodology*, ASME, pp. 495–504.

[88] Atman C. J., Chimka J. R., Bursic K. M., and Nachtmann H. L., 1999, “A comparison of freshman and senior engineering design processes,” *Des. Stud.*, **20**(2), pp. 131–152.

[89] Viera A. J., and Garrett J. M., 2005, “Understanding interobserver agreement: The kappa statistic,” *Fam. Med.*

[90] Landauer T. K., Foltz P. W., and Laham D., 1998, “An introduction to latent semantic analysis,” *Discourse Process.*, **25**(2–3), pp. 259–284.

[91] Evangelopoulos N. E., 2013, “Latent semantic analysis,” *Wiley Interdiscip. Rev. Cogn. Sci.*

[92] Renu R. S., and Mocko G., 2016, “Computing similarity of text-based assembly processes for knowledge retrieval and reuse,” *J. Manuf. Syst.*, **39**, pp. 101–110.

[93] Wetmore W. R., Summers J. D., and Greenstein J. S., 2010, “Experimental study of influence of group familiarity and information sharing on design review effectiveness,” *J. Eng. Des.*, **21**(1), pp. 111–126.

[94] Arnold H. J., Moore D. S., and McCabe G. P., 1990, “Introduction to the Practice of Statistics,” *Technometrics*, **32**(3), p. 347.

APPENDICES

Appendix A. Experiment Packets A and B

Date: __________

Packet A

Please provide the first two letters of your mother's first name followed by the date of the month you were born on (2 digits) in the space below.

For example: my mother's first name is Stefania and I was born on the fourth of July. Therefore, mine would be: ST04.

____

Instructions:

Considering this problem, please generate a requirement document as complete as possible to be handed off to the conceptual design team.

Problem Statement:

In order to help people in wheel chairs to grab books from the highest level of the bookshelf (at 6 ft or above), a mechanism needs to be developed. The device must be safe to use, convenient, and operate smoothly without damaging the books. The assembly should be relatively simple so that it can be installed on most existing bookshelves.

Date: __________

Packet B

Please provide the first two letters of your mother's first name followed by the date of the month you were born on (2 digits) in the space below.

For example: my mother's first name is Stefania and I was born on the fourth of July. Therefore, mine would be: ST04.

____

Instructions:

Considering this problem, please generate a requirement document as complete as possible to be handed off to the conceptual design team.

Problem Statement:

Design a safety lock for a bicycle that is to be permanently fastened to it (not to be removed when being used). The lock is to be a lasting accessory, yet can still be removed or adjusted if necessary. It should be small enough to be non-obtrusive to the bicyclist while riding and should be light weight and relatively inexpensive.

1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	

12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	

23	
24	
25	
26	
27	
28	
29	
30	
31	
32	
33	

34	
35	
36	
37	
38	
39	
40	
41	
42	
43	
44	

Appendix B. Raw List of Requirements

Raw Data		
ID	P-Code	Requirement
AN09	B1	Mounted to bike (when in use and not in use)
AN09	B1	Not too heavy
AN09	B1	Durable to the elements
AN09	B1	Secure from easy compromise (if it was bolt cutter proof that's be great)
AN09	B1	Out of the way when riding
AN09	B1	Easily removed/adjusted
AN09	B1	Not too bulky and out of the way
AN09	B1	Not too expensive
AN09	B1	Easily locked/unlocked
GI21	B1	Must be a lock
GI21	B1	Non-obtrusive
GI21	B1	Lightweight
GI21	B1	Cheap to make
GI21	B1	Longlasting
GI21	B1	Not removed during use
GI21	B1	Adjustable
GI21	B1	Integrated as part of bike
CH15	B1	Bike lock that will fit on many different size objects
CH15	B1	Lock that is tamper proof
CH15	B1	Can only be removed from bicycle when unlocked
CH15	B1	Small in overall size so that it doesn't affect while riding
CH15	B1	Weather proof material (doesn't rust)
CH15	B1	Non generic key, only opens with specific key
CH15	B1	Should not be able to cut through lock
CH15	B1	Determine mounting point on bike to lock it
CH15	B1	Be sure it doesn't get in the way of bottle holder and other accessories
CH15	B1	Can handle large amounts of vibration
CH15	B1	Impact resistance
CH15	B1	Should come with main key as well as backup key
SU02	B1	Safety lock must not get in the way of the use of the bicycle
SU02	B1	Lock cannot add noticable weight during used bicycle
SU02	B1	Lock must survive impacts from bike crashes
SU02	B1	Lock can only be removed by person who's lock it is
SU02	B1	People cannot break lock
SU02	B1	Lock must be able to adjust position, tightness
SU02	B1	Lock should be removable
SU02	B1	Cannot serve as an eyesore
SU02	B1	Must be able to "lock" onto something
LO01	B1	Durable design
LO01	B1	High strength
LO01	B1	Simple
LO01	B1	Lightweight
LO01	B1	Inexpensive to make/add on
LO01	B1	Must have locking mechanism
LO01	B1	Must allow for adjustment
LO01	B1	Must allow for removal if needed
LO01	B1	Durable materials
LO01	B1	Match the design of the bike
LO01	B1	Must be able to be used easily
LO01	B1	Securely fastened to bike
LO01	B1	Does not interfere with operation of bike
LO01	B1	Materials must be able to prevent someone from breaking them or cutting through them
LO01	B1	Must be able to be used safely, without danger to user
LO01	B1	Must allow for fast unlocking and locking
LO01	B1	Must be comparable to other bike locks
LO01	B1	Must be easy to manufacture
JU02	B1	An effective safety lock
JU02	B1	Can be permanently fastened to bike
JU02	B1	Removable and changeable by owner
JU02	B1	Not affect bike or riders performance/riding experience
JU02	B1	Relatively inexpensive
JU02	B1	Not removable while bike is in use
JU02	B1	Built to last at least 2 years
LO03	B1	Lock should be functional and not easily breakable
LO03	B1	Lock should not interfere with functionality of bike
LO03	B1	Lock should be permanently fastened to the bike
LO03	B1	Lock should not cost more than $50
LO03	B1	Lock should not weigh more than 5lbs
LO03	B1	Lock should only be removable by owner of bike
LO03	B1	Lock should be tamper proof
LO03	B1	Lock should remain stationary while bike is in use
AM20	B1	Lightweight
AM20	B1	Permanent
AM20	B1	Long lasting
AM20	B1	Needs to be tough (go through wear)
AM20	B1	While being permanent still needs to be able to be removed
AM20	B1	Adjustable lock
AM20	B1	Small enough to not be noticed but still strong enough
AM20	B1	Materials that make up the lock should be inexpensive
AM20	B1	Should be able to go on multiple places on the bike
MA19	B1	Lock must be permanently fastened
MA19	B1	Light weight
MA19	B1	Durable

MA19	B1	Relatively inexpensive
MA19	B1	Removable
MA19	B1	Adjustable
MA19	B1	Can't obscure the rider
MA19	B1	Manufacturable
MA19	B1	Able to stand up to weather
MA19	B1	Safety lock must not get in the way of the use of the bicycle
MA19	B1	No pinching hazards
MA19	B1	Big enough not to be swallowed by a child
MA19	B1	Aesthetically pleasing
MA19	B1	Shock absorbant
MA19	B1	No sharp edges
MA19	B1	Rust-proof
MA19	B1	Able to fit around standard bikes
MA19	B1	Water resistant
MA19	B1	Able to stand up to pliers
MA19	B1	Tasty?
MA19	B1	Capable of love
SA11	B1	Permanently fastened when in use
SA11	B1	Lightweight
SA11	B1	Inexpensive
SA11	B1	Ability to remove/adjust when not in use
SA11	B1	Small? Non-obtrusive
SA11	B1	Durable/long-lasting
SA11	B1	Reliable
SA11	B1	Ability to lock
SA11	B1	Material selection: not brittle or corrosive
JE06	B1	Permanently fastened to bike
JE06	B1	Cannot be removed when being used
JE06	B1	Lasting accessory
JE06	B1	Can be removed or adjusted if necessary
JE06	B1	Small
JE06	B1	Light weight
JE06	B1	Inexpensive
JE06	B1	Won't rust
JE06	B1	Strong material; can take crashes
JE06	B1	Easy to use
JE06	B1	Cannot be disassembled easily
JE06	B1	Functions as a safety lock
JE06	B1	Non-obtrusive to the bicyclist while riding
JE06	B1	Can withstand the outdoors
JE06	B1	No sharp edges
JE06	B1	Safe to use
JE06	B1	Password protected
JE10	B1	Must be a safety lock
JE10	B1	Must be for a bike
JE10	B1	Must be permanently fastened to the bike
JE10	B1	Safety lock cannot be removed from bike when in use
JE10	B1	Design a safety lock
JE10	B1	The lock must be a lasting accessory
JE10	B1	The lock size, shape, weight, location cannot interfere with the mobility of the bike
JE10	B1	Can be removed and adjusted when bike not in use
JE10	B1	Must be lightweight (<5lb)
JE10	B1	Must be inexpensive (<$30)
JE10	B1	Must have a code or key to open
JE10	B1	Must be able to be opened by user once locked
JE10	B1	Must be able to fit around bike rack/ fence/ etc.
JE10	B1	Must not rust/decay in a way that inhibits usage
JE10	B1	Must not break if pulled on
JE10	B1	Cannot be easily broken (thus stolen)
TA06	B1	Must have a metal base
TA06	B1	Must cost less than $100
TA06	B1	Must not corrode
TA06	B1	Must not be noisy
TA06	B1	Must be safe
TA06	B1	Must be able to retract
TA06	B1	Must have warranty
TA06	B1	Must come with a reflector
TA06	B1	Must be waterproof
TA06	B1	Must handle great difference in altitude
TA06	B1	Must work for all standard bicycle
TA06	B1	Must be able to clamp in place
TA06	B1	Must be reliable up to 3 years
TA06	B1	Must handle high speeds
TA06	B1	Must handle wear
BR02	B1	Device needs to be able to secure bicycle to a fixed object
BR02	B1	Device must not interfere with operation of bicycle

BR02	B1	Device must not exceed 3 lbs
BR02	B1	Footprint must not exceed
AN11	B1	Light weight
AN11	B1	Durable
AN11	B1	Able to adjust to lock on to various items based on circumstances
AN11	B1	Locking mechanism using key or code
AN11	B1	Memorable
AN11	B1	Portable
AN11	B1	Can be hand held
KA05	B1	Must lock bike
KA05	B1	Small
KA05	B1	Light weight
KA05	B1	Cheap
KA05	B1	Attached to frame (but not permanently)
KA05	B1	Weather proof
KA05	B1	Adjustable
KA05	B1	Can't be cut
CI26	B1	Safety lock
CI26	B1	Permanently fastened to frame
CI26	B1	Removable
CI26	B1	Adjustable
CI26	B1	Non-obtrusive to rider
CI26	B1	Light weight
CI26	B1	Inexpensive
CI26	B1	Lasting
LY04	B1	Permanently fastened when in use
LY04	B1	Needs to last a long time
LY04	B1	Can be removed or adjusted
LY04	B1	Small enough so its not in the way
LY04	B1	Light weight
LY04	B1	Relatively inexpensive
LY04	B1	Safe to use
LY04	B1	Not break easily
LY04	B1	Needs to be able to unlock
LY04	B1	Simple to use
LY04	B1	Be resistant to rusting
JE17	B1	The lock must securely lock the bike
JE17	B1	It must be able to be connected to the bike when the bike is operating
JE17	B1	It must be able to be taken off the bike when not in use
JE17	B1	It must be less than 2lbs
JE17	B1	It must fit in a certain area to not be in the users way
JE17	B1	It must be adjustable
JE17	B1	It must be made of a sturdy material, not easily breakable
JE17	B1	It shall not be made of corrosive material
JE17	B1	It will cost less than $20 to sell
SA06	B1	Design safety lock for bike
SA06	B1	Must permanently fasten to bike
SA06	B1	Must be able to be moved or adjusted
SA06	B1	Needs to be small and un-obtrusive
SA06	B1	Light weight
SA06	B1	Inexpensive
MA02	B1	Must securely lock bike to structure
MA02	B1	Must be cut-resistant
MA02	B1	Must be easy to use (lock/remove)
MA02	B1	Must be permanently fastened to the bike
MA02	B1	Must be unobtrusive to rider
MA02	B1	Must be inexpensive
MA02	B1	Lock should be flexible as it needs to take on many shapes
MA02	B1	Must be able to extend over necessary distances
MA02	B1	Be lightweight so as to not slow rider down
MA02	B1	Must be made out of materials resistant to wear and corrosion
MA02	B1	Able to withstand environmental and outside conditions
MA02	B1	Adjustable/fitable in an easy manner so that any problems can be dealt with easily
MA02	B1	Removable if entirely needed, but with special lock key so theifs cannot remove it
CA11	B1	Permanently fastened during use
CA11	B1	Can be removed or adjusted outside of use
CA11	B1	Durable at typical use cases
CA11	B1	As a lock, must be tamper-resistant
CA11	B1	Must be much harder to remove without key than with it
CA11	B1	Water resistant
CA11	B1	Temperature resistant (any human-operable temperature)
MA01a	B1	Bicycle safety lock must be able to lock a bicycle to a bick rack or sign pose
MA01a	B1	Bicycle safety lock must not produce noticeable effects while bicycle rider rides the bike
MA01a	B1	Bicycle safety lock must not need to get removed from bicycle in order to lock bicycle to bike rack or sign post
MA01a	B1	Bicycle safety lock must withstand wet weather
JO04	B1	Inexpensive (price under $X)
JO04	B1	Lock must weigh less than X lbs

JO04	B1	Lock must permanently fasten to bicycle
JO04	B1	Lock must not interfere with cycling motion
JO04	B1	Lock is removable with the proper key/tools
JO04	B1	Lock's position may be flexible/adjustable
JO04	B1	Lock must have a high durability
JO04	B1	Lock must properly fit and lock into a bike rack
JO04	B1	Lock must be able to withstand high forces
JO04	B1	Lock must pass corrosion testing
LA07	B1	Must be able to keep the bike from being stolen
LA07	B1	Must be permanently attached to the bike
LA07	B1	Must be less than 4 lb
LA07	B1	Must cost less than $10
LA07	B1	Must be able to fit in a box 4inx4inx2in
LA07	B1	Must be adjustable by the user
LA07	B1	Must not interfere with normal function of the bike
MI16	B1	Securely lock a bike
MI16	B1	Weighs less than 5 lbs
MI16	B1	Cost less than $30
MI16	B1	Can be securely fastened to bike frame
MI16	B1	Will not fall off bike frame
MI16	B1	Can be removed to adjust
MI16	B1	Fit on the frame underneath rider
MI16	B1	Not take up a volume > 50in^3
CH02	B1	Must be able to attach onto a standard bike frame tube thickness-possibly adjustable
CH02	B1	Cannot stick out more than 2-in from frame of bike when attached
CH02	B1	Can only be removed from bike with use of a factory provided tool/key
CH02	B1	Made of light weight, corrosion resistant material
CH02	B1	Biker can lock and unlock by use of a key code so they do not need to carry key with them
CH02	B1	Needs to be a strong enough material so it cannot be broken easily
LI14	B1	Should not be able to be removed by any means once locked
LI14	B1	Durable enough to withstand frequent use in all elements for many years
LI14	B1	Should be repositionable when unlocked by the owner
LI14	B1	Should not interfere with the rider's ability to ride safely and comfortably
LI14	B1	Should be relatively inexpensive to manufacture
LI14	B1	Should be light weight i.e. not noticeable when riding
CH11	B1	Able to be fastened and removed from bike
CH11	B1	Not able to be removed without key code
CH11	B1	Weather proof
CH11	B1	Hold up to cyclic use (continual locking and unlocking)
CH11	B1	Non-obtrusive while riding
CH11	B1	Light weight
CH11	B1	Inexpensive (relatively)
CH11	B1	Simple design (easy to use)
CH11	B1	Locks frame, not wheel (wheel can be easily removed)
CH11	B1	Locks to stable object so can't be moved
CH11	B1	Locks bike in a way that renders it unable to roll - difficult to move
TE30	B1	Light weight
TE30	B1	Non-obtrusive
TE30	B1	Should be permanently mounted to bike (not removed to use bike)
TE30	B1	Small in comparison to bike
TE30	B1	Inexpensive
TE30	B1	Can be removed if necessary
TE30	B1	Adjustable
TE30	B1	User friendly
TE30	B1	Easy to use/install
TE30	B1	Difficult to break/steal
TE30	B1	Material cost
MA01b	B1	Safety lock for bicycle
MA01b	B1	Must be able to be permanently fastened to bicycle
MA01b	B1	Must be adjustable/removable if necessary
MA01b	B1	Must be small enough to not interfere with riding of bicycle
MA01b	B1	Must be lightweight
MA01b	B1	Must be relatively inexpensive
MA01b	B1	Conform with safety standards, legal standards, non-toxic, etc.
BA23	B1	Lock must be less than $30
BA23	B1	Lock must weigh less than 1 lb
BA23	B1	Lock must be removable from bike for adjustment/maintenance
BA23	B1	Lock must not come into contact with rider during bicycle operation
BA23	B1	Lock must require tools for removable
BA23	B1	Lock must be adjustable without use of tools
BA23	B1	Lock must have a 4 digit code entry system
BA23	B1	Lock must be/become large enough to fit common bike racks
BA23	B1	Lock must be able to withstand rain, dust, moisture, and a range of temperatures
BA23	B1	Lock must be able to withstand impacts from bike collisions, falls, or hammers
BA23	B1	Lock must not interfere with a range of bike mounting
KA19	B1	Able to remain attached when bike is in use
KA19	B1	Removable and repositionable

KA19	B1	Light weight material
KA19	B1	Cost effective, material and manufacturing
KA19	B1	Relatively small
KA19	B1	Non-obtrusive
KA19	B1	Durable materials
KA19	B1	Aesthetically pleasing
KA19	B1	Strong material
TA18	B1	Must stay fastened to bike while bike is in use
TA18	B1	Can be adjusted/removed
TA18	B1	Must securely lock bike to structure
TA18	B1	Must nonobstructive while bike is ridden
TA18	B1	Must be made out of lightweight materials
TA18	B1	Needs to be inexpensive
TA18	B1	Lock needs to be able to be used on standard bike rack
TA18	B1	Easy to lock
TA18	B1	Needs to secure frame and front tire
TA18	B1	Not easy to cut through
TA18	B1	Easy to unlock with key/ code/other
DE09	B1	Must not impede the bike's usage when not engaged
DE09	B1	Must endure continuous use without failing
DE09	B1	Must securely lock the bike to a nearby fixture when engaged
DE09	B1	Must be removable, only when not engaged
DE09	B1	Must include adjustability to assist with R1
DE09	B1	Must restrict the ability to engage/disengage the lock via a key, combination, etc.
DE09	B1	Must be difficult to disengage without the criterion specified in R6, requiring mechanical assistance to break
KA09	B1	Bike is immovable/attached to a secure object while lock is engaged
KA09	B1	Lock is removable (not while in use)
KA09	B1	Lock is small
KA09	B1	Lock is cheap
PE06	B1	Safety lock for bicycle
PE06	B1	Lightweight
PE06	B1	Strong metal
PE06	B1	Non corrosive
PE06	B1	Forged
PE06	B1	Two locks total; one on each end
PE06	B1	Can easily be connected to the main frame of bike
PE06	B1	Can easily be stowed by wrapping around main frame
PE06	B1	Relatively inexpensive
PE06	B1	Adjustable configuration
PE06	B1	Non-obtrusive
PE06	B1	One, inexpensive color
PE06	B1	Simple code locks
AS17	B1	Prevents bike theft
AS17	B1	Remains attached to bike during use
AS17	B1	Durable
AS17	B1	Adjustable
AS17	B1	Removable
AS17	B1	Small/lightweight
AS17	B1	Inexpensive
AS17	B1	Unobtrusive
AS17	B1	Easy to use
RO02	B1	The safety lock shall be permanently attached to the bicycle frame
RO02	B1	The safety lock shall be resistant to corrosion (i.e. will not rust)
RO02	B1	The safety lock shall be storable beneath the bicycle seat so it does not obstruct operation of the bicycle
RO02	B1	The safety lock shall be lightweight (i.e. less than five pounds)
RO02	B1	The safety lock shall cost less than $20 so it is inexpensive
RO02	B1	The safety lock shall be mass produced to make it more economical
TO09	B1	The lock should be secure to the bike when in use
TO09	B1	The lock should be lightweight
TO09	B1	The lock should be inexpensive
TO09	B1	The lock should be shock resistant
TO09	B1	The lock should be weather resistant (no corrosion)
TO09	B1	The lock should be easy to secure on the bike
TO09	B1	The lock should be small enough to be unobtrusive when riding
TO09	B1	The lock's position should be adjustable
TO09	B1	The lock should operate in all temperatures
SO07	B1	Should have 2 locks (1 for usage (primary), one for permanent installation (secondary))
SO07	B1	Should have an adjustable length that cannot be tampered with while in use: dependent on primary lock
SO07	B1	The secondary lock may not be removed before the primary
SO07	B1	The apparatus needs to be stowable (curl cord and lock around secondary lock?)
SO07	B1	Must be no more than 1.25 times as expensive as the average mid-range bike lock
SO07	B1	Locks must be highly durable (weather and shock proof)
SO07	B1	Cordage must withstand anything short of a chain-saw
SO07	B1	Should not weigh more than the average bike lock
BH15	B1	Must secure the bike
BH15	B1	Must be a lasting accessory
BH15	B1	Must be removable

BH15	B1	Must be adjustable
BH15	B1	Light weight
BH15	B1	Non obtrusive to cyclist
BH15	B1	Small
BH15	B1	Inexpensive
BH15	B1	Strong
BH15	B1	Easy to replace
BH15	B1	Must be able to change combination
BH15	B1	Durable
BH15	B1	Waterproof
BH15	B1	Shock-resistant
BH15	B1	Large enough to secure to different objects
BH15	B1	Adjustable so that the lock can be attached to different things
BH15	B1	Can secure a bike
BH15	B1	Mountable to all tyres of bikes
BH15	B1	Cannot be removed without using combinations first
BH15	B1	Safe design. Nothing can harm someone by touching it
BH15	B1	Rust-proof
CA21	B1	Must be fastened to the bicycle
CA21	B1	Must be able to be unfastened
CA21	B1	Must be corrosion resistant
CA21	B1	Must lie flush with the bike's frame
CA21	B1	Must be able to swing out for use
CA21	B1	Must lock bike
CA21	B1	Must unlock with a key
CA21	B1	Must be made of strong material
CA21	B1	When in the flush position, must remain that way
CA21	B1	Must be inexpensive
CA21	B1	Must be made with sustainable materials
KI10	B1	The lock must be small relative to the bicycle
KI10	B1	The lock must be lightweight
KI10	B1	The lock must be inexpensive
KI10	B1	The lock must be durable
KI10	B1	The lock must be safe
KI10	B1	The lock must be capable of locking
KI10	B1	The lock must be able to be permanently fastened while in use
KI10	B1	The lock must be removable when not in use
KI10	B1	The lock must be adjustable when not in use
KI10	B1	The lock must fasten to a place on the bicycle that does not obstruct the bicyclist
JO26	B1	Not stolen with normal tools
JO26	B1	Should fit most bicycles
JO26	B1	Should be permanently fastened
JO26	B1	Non-obtrusive
JO26	B1	Lightweight
JO26	B1	Inexpensive
JO26	B1	Long lasting
JO26	B1	Low maintenance
JO26	B1	No locked shut malfunctions
JO26	B1	Easy to find thing to lock to
KA10b	B1	"Safety lock" variety
KA10b	B1	Permanently fastened to the bicycle
KA10b	B1	Smaller than 4inx4inx1in
KA10b	B1	Cost less than $12 retail
KA10b	B1	Adjustable for >6 positions
KA10b	B1	Won't interrupt the bicyclist's motion
KA10b	B1	Lifespan >4 years with daily use
KA10b	B1	Weigh <7 ounces
KA10b	B1	Provide maximum bicycle safety
DA19	B1	The lock should withstand an excessive amount of fatigue cycles (75000 uses)
DA19	B1	The lock should not be easily removable (if adjusted)
DA19	B1	The lock should be easily visible/identifiable
DA19	B1	The lock should be simple enough for a child to be able to use
DA19	B1	The lock should be placed in an easy to reach/access location
DA19	B1	The lock should weigh no more than 2 lbs
DA19	B1	The lock should be made of a non corrosive material (be weather resistant)
LI09	B1	The safety lock must be small enough to not interfere with the rider
LI09	B1	The lock must be able to withstand constant impact
LI09	B1	The lock must have an adjustment to extend the locking bar if necessary
LI09	B1	The lock must be able to be fully removed from the bicycle
LI09	B1	The lock must be made out of a material that is durable enough to last several years
LI09	B1	The lock must have a protective coating/pad to reduce sound when riding
LI09	B1	The lock must be made out of a material that is inexpensive
CH21	B1	The safety lock shall be removable if necessary
CH21	B1	The safety lock shall be adjustable
CH21	B1	The safety lock shall last for at least 10 years
CH21	B1	The safety lock shall not impede rider motion
CH21	B1	The safety lock shall weigh less that 2 pounds

CH21	B1	The safety lock should cost no more than $20 dollars
CH21	B1	The safety lock shall be fastened to the bicycle
SU11A	B1	The lock must cost <$5/lock to manufacture
SU11A	B1	The lock must weigh less than 2lbs
SU11A	B1	The lock must be able to be removed from the bike when not in use
SU11A	B1	The lock must be able to stay on the bike under rough riding conditions
SU11A	B1	The lock must not interfere with the rider's bicycling
JO04b	B1	The safety lock is permanently fastened to the bicycle
JO04b	B1	The safety lock can be removed when necessary
JO04b	B1	The safety lock can be adjusted when necessary
JO04b	B1	The safety lock should not require removal to be used
JO04b	B1	The safety lock should be unobtrusive to the rider during normal riding conditions
JO04b	B1	The safety lock should be light weight
JO04b	B1	The safety lock should be cheap
JO04b	B1	The safety lock should be corrosion resistant
JO04b	B1	The safety lock should be durable (i.e. shock resistant)
JO04b	B1	The safety lock should be able to lock and unlock
SU08	A1	Safe for use
SU08	A1	Controls must be within reach/view of wheelchair bound user (between 2.5 and 4 feet from the ground)
SU08	A1	Must not damage books
SU08	A1	Assembly must be bookshelf mounted
SU08	A1	Must fit most bookshelves
SU08	A1	Book must be deposited within wheelchair bound user (between 2.5 and 4 ft from ground)
SU08	A1	Must not obstruct wheelchair paths on ground
SU08	A1	Must be able to recognize which book is to be retrieved
SU08	A1	Must be capable of reaching shelves over 6 ft from ground
SU08	A1	Must be powered via a method conventional to a home setting
SU08	A1	Must not require excessive force from user to operate
MA11a	A1	Safe to use
MA11a	A1	Convenient
MA11a	A1	Operate smoothly
MA11a	A1	Will not damage books
MA11a	A1	Must reach 6 feet (or higher)
MA11a	A1	Must be able to grab and retrieve books from bookshelf
MA11a	A1	Hand operated?
SH21	A1	Must successfully grab a book
SH21	A1	Must be able to hold onto the book
SH21	A1	Safe to use
SH21	A1	Convenient
SH21	A1	Easy installation
SH21	A1	Allow people in wheelchair to remain seated
SH21	A1	Must be able to retrieve books at high levels (6ft or above)
SH21	A1	Should be easy for the person in the wheelchair to bring the book down to themselves
SH21	A1	Should be able to grab different sizes of books
SH21	A1	Be able to grab a book while somehow keeping the other books from falling over due to the empty spot
SH21	A1	No sharp points to damage user or book
SH21	A1	Someone should be able to use it easily without seeing it before
AL14	A1	Must be safe for operator to use causing no injury to user
AL14	A1	Must be able to not damage books while in use
AL14	A1	Must be simple enough for children to use
AL14	A1	Must have a shutdown switch/code if it malfunctions
AL14	A1	Must have a dimensional volume/area small enough to be places on shelf or wheelchair
AL14	A1	Must have a mass/weight light enough not to fall off or trip over bookshelves
AL14	A1	Must have outer casing so that the device does not get tampered with
AL14	A1	Outer casing must be safe to touch and interact with
AL14	A1	Must be cost effective to provide a profit
AL14	A1	Must be accessible to those in a wheelchair to where it doesn't interfere with their daily activities
AL14	A1	Must have an access area to the mechanical components for repairs
KR20	A1	Must reach top shelf
KR20	A1	Safe to use (cannot topple shelf)
KR20	A1	Must be able to grab book and bring within grabbing distance
KR20	A1	Simple assembly
KR20	A1	Work with new and old bookshelves
KR20	A1	Cannot damage books
KR20	A1	Person in the wheelchair must be able to operate mechanism
KR20	A1	Can't block user from seeing the books
MI18	A1	Safe for the user to handle
MI18	A1	Safe transfer of books without damaging them
MI18	A1	Allow books to be taken or put back on shelves
MI18	A1	Must reach at least to 6 ft in total height from wheelchair level
MI18	A1	Easily installed to book shelves
MI18	A1	Easily removed from book shelves
MI18	A1	Easy manuverability without intricate design
MI18	A1	Easy usability (button activation/mechanical grabbing)
MI18	A1	Relatively cheap production to place on every shelf
MI18	A1	Reliable mechanism to grasp book
MI18	A1	Easy to remove selected book without tumbling others or grabbing multiple at once

MI18	A1	Way to replace book in between other books
MI18	A1	If bar style is used, needs to be stable when raising it above the head to accurately make selection
MI18	A1	If bar style, must be lightweight in design with solid gripping portion
MI18	A1	Must be able to grip all textures of books to prevent slipping
MI18	A1	Minimal moving parts to break
KA10	A1	Device must be able to reach at least 6 ft
KA10	A1	Device must be small enough to be stored on a bookshelf
KA10	A1	Device must be safe to use
KA10	A1	Device must be able to access at least the upper shelves of a bookshelf
KA10	A1	Device must grip books securely without damaging them
KA10	A1	Device must be compatible with a variety of book shelves
KA10	A1	Device must be able to grab books quickly
KA10	A1	Device must operate with minimal noise
KA10	A1	Device must not restrict movement around the base of the bookshelf
KA10	A1	Device must be usable from a seated position
MA11b	A1	Safe
MA11b	A1	Cannot damage books
MA11b	A1	Must be able to be used on most bookshelves
MA11b	A1	Able to reach books at least 6 ft. or above
MA11b	A1	Wheelchair friendly
MA11b	A1	Must make it easier for handicapped people to reach books on a bookshelf
MA11b	A1	Easy to operate
ME11	A1	The device shall not cause (further) bodily harm to the operator
ME11	A1	The device shall be capable of being toggled from up and down, or "reachable by wheelchair", positions from a wheelchair
ME11	A1	The device, when installed/operated, must not impede foot traffic in the room/bookshelf walkways
ME11	A1	The device shall not require significant physical strength to operate
ME11	A1	The device shall not damage books in any way
ME11	A1	The device shall be capable of mounting all bookshelves present in a representative library: cooper library
ME11	A1	The device shall be capable of being installed by an unskilled operator
WE31	A1	Mechanism must have no sharp edges
WE31	A1	Mechanism must be able to secure itself to the wheelchair so that it does not fall on the user
WE31	A1	Mechanism must be less than 10 lbs
WE31	A1	Mechanism must be able to be extended to 6 ft from the sitting position
WE31	A1	Mechanism must be able to retract into a compact state where it is smaller than 2'x4''x4''
WE31	A1	Mechanism must be able to grab books from 1/4" thick to 4" thick
WE31	A1	Mechanism must be strong enough to hold heavy books so that they do not fall on the user
WE31	A1	Mechanism must retract with the book in a way that doesn't become too heavy for the user
BE02	A1	Must be able to grab books 6 ft high
BE02	A1	Can't damage books
BE02	A1	Safe to operate
BE02	A1	Simple installation
BE02	A1	Accessible to people in wheel chairs
BE02	A1	Simple to operate
LA04	A1	Must be operable by a person in a wheelchair
LA04	A1	Must reach and retrieve books that are at least 6 feet kap the shelf
LA04	A1	Device must not damage the book
LA04	A1	Device must cost under $50
LA04	A1	Device must be able to be shipped in a 1'x1'x1' box
MI02	A1	Safe
MI02	A1	Convenient
MI02	A1	Smooth operation
MI02	A1	Non-damaging to books
MI02	A1	Simple assembly
MI02	A1	Installable on existing bookshelves
MI02	A1	Usable by someone in a wheelchair
MI02	A1	Long enough to reach books from 6+ft.
MI02	A1	Safe for children to be around
MI02	A1	Non-messy (house setting)
MI02	A1	Lightweight
MI02	A1	Operates quickly
MI02	A1	Easily shipped
MI02	A1	Good price range
PA27	A1	Safe
PA27	A1	Convenient
PA27	A1	Operate smoothly
PA27	A1	Not damage books
PA27	A1	Accommodate people in wheel chairs
PA27	A1	Reach books 6 ft or above
PA27	A1	Able to be installed on most existing bookshelves
PA27	A1	Allows people to grab books
NA21	A1	Assembly must be 6 ft or higher in height
NA21	A1	Must be safe
NA21	A1	Must be convenient
NA21	A1	Books cannot be damaged
NA21	A1	Almost universal or adjustable
NA21	A1	Cost effective, material and manufacturing
NA21	A1	Limited material with simple shapes used

NA21	A1	Easy to manufacture
NA21	A1	Limited amount of motion to decrease chance of breaking
NA21	A1	Can handle different weights of books
NA21	A1	Different shaped books can be handled too
NA21	A1	Simple manufacturing processes to create components
NA21	A1	Component handling book has low wear material
NA21	A1	Most component material can handle room temperature
MI29	A1	Safe
MI29	A1	Convenient
MI29	A1	Operate smoothly
MI29	A1	No damage to books
MI29	A1	Must reach minimum 6 ft
MI29	A1	Simple
MI29	A1	Can be installed on most bookshelves
ML02	A1	Safe to use
ML02	A1	Convenient to use
ML02	A1	Operate without damaging books
ML02	A1	6 ft
DA02	A1	Must be safe to use
DA02	A1	Wheel chair accessible
DA02	A1	Cannot invoke fear
DA02	A1	Must help people grab books higher than 6 ft.
DA02	A1	Usable with books on bookshelf
DA02	A1	Quick
DA02	A1	Easy to use
DA02	A1	Intuitive
DA02	A1	Utilize a logical process
DA02	A1	Affordable
DA02	A1	Suited for home use
DA02	A1	Able to withstand many uses
DA02	A1	Durable materials
DA02	A1	Smooth operation
DA02	A1	Gentle operation
DA02	A1	Cannot damage books
DA02	A1	Easy to maintain
DA02	A1	Quiet operation
KI01	A1	Must be safe
KI01	A1	Maintenance-free
KI01	A1	Quiet
KI01	A1	Easy to install
KI01	A1	Inexpensive
KI01	A1	Small footprint
KI01	A1	Easy to manufacture
KI01	A1	Compatible with all bookshelves
KI01	A1	Easy to use
KI01	A1	Gentle on the books
KI01	A1	Grab books of all sizes
KI01	A1	Constant power or batteries that last the product's entire lifetime
KI01	A1	Put books up and down
KI01	A1	Easy to use UI
KI01	A1	Hold heavy books too
KI01	A1	Be able to grab books from the ends
KI01	A1	Adjust by itself to the size of the book
KI01	A1	Low cost to manufacture
KI01	A1	Ships in smallest box possible
LI11	A1	Safe
LI11	A1	Not damage books
LI11	A1	Simply assembly
LI11	A1	Reach at least 6 ft up
LI11	A1	Convenient
LI11	A1	Must be able to be installed on most bookshelves
LI11	A1	Operate smoothly
LI11	A1	Able to grab books from shelf
JA12	A1	Reach shelves above 6 ft
JA12	A1	Safe to use
JA12	A1	Don't damage books
JA12	A1	Able to be installed on most existing shelves
JA12	A1	Be usable by people in wheelchairs
LA11	A1	Must not cause damage to books
LA11	A1	Must not harm the operator
LA11	A1	Must be able to reach books at 6 ft minimum
LA11	A1	Must be operatably by someone in a wheelchair
LA11	A1	The design must allow easy installation on an existing bookshelf
LA11	A1	Device should have simple, self-explanatory controls
LA11	A1	Device must fasten securely to shelf
LA11	A1	Device must operate quietly
LA11	A1	Device must have low maintenance

LA11	A1	Must be reliable up to 3 years
LA11	A1	Must be low cost
LA11	A1	Operate on 12 V power supply wall socket
LA11	A1	Device must retrieve the book quickly
LA11	A1	Government/industry standard requirements?
LE08	A1	Can raise chair to within 2 ft of top shelf
LE08	A1	Can withstand 500lbs of force
LE08	A1	Wide enough to accommodate wheelchair
LE08	A1	Ramp for wheelchair to enter
LE08	A1	Manual control for user to ascend/descend
CH01	A1	Must be safe
CH01	A1	Must be able to grab and return book sized object
CH01	A1	Must be able to reach 6 ft
CH01	A1	Must be able to be used by less disabled persons
CH01	A1	Must be able to be attached to "standard bookshelf" (adjustable)
CH01	A1	Should have a smooth operation
CH01	A1	Should not add >'x' to bookshelf footprint
CH01	A1	Should be able to withstand wheelchair impacts
CH01	A1	Must not compromise safety on shelf
KA02	A1	Grab books
KA02	A1	Operate at over 6 ft
KA02	A1	Safe
KA02	A1	Convenient
KA02	A1	Operate smoothly
KA02	A1	Not damage books
KA02	A1	Simple (relatively) to operate
KA02	A1	Must fit onto existing bookshelves
KA02	A1	Must be able to be operated by handicap people
KA02	A1	Must not interfere in operation of wheel chairs
KA02	A1	Must not interfere with books on low levels
KA02	A1	Should not interfere with other users getting books
KA02	A1	Simple to install
KA02	A1	Simple to uninstall
KA02	A1	Should not damage bookshelves
SH16	A1	Must be safe to use
SH16	A1	Must be convenient to the user (handicap friendly) (easy to operate) (lightweight)
SH16	A1	Must operate smoothly
SH16	A1	Must not damage the books
SH16	A1	Must have a simple assembly
SH16	A1	Must be able to install of a majority of bookshelves
SH16	A1	Must reach the top shelf (6ft or above)
SH16	A1	Must be able to grab a book without dropping it
BA25	A1	Safe to use
BA25	A1	Not damage any books
BA25	A1	Simple design
BA25	A1	Relatively inexpensive
BA25	A1	Easy to use
BA25	A1	All types of people in wheel chairs must be able to use
BA25	A1	Long lasting/durable
BA25	A1	Reach highest shelf (6ft)
BA25	A1	Does not harm anyone/anything
JE11	A1	Must grab books safely - no dropping/damaging books
JE11	A1	Must be easily integrated into existing shelves
JE11	A1	Must reach highest shelf/extend to ~2' off ground
JE11	A1	Must be inexpensive
JE11	A1	Must choose correct book
JE11	A1	Must be user friendly
JE11	A1	Must not stick out too far from shelf-safety!
JE11	A1	Must be quiet/operate smoothly
MI29a	A1	Must be a mechanism
MI29a	A1	Must be safe
MI29a	A1	Must be convenient
MI29a	A1	Must operate smoothly
MI29a	A1	Must not damage books
MI29a	A1	Must reach the highest level of books (>6ft)
MI29a	A1	Assembly should be relatively simple
MI29a	A1	Assembly should be easy to install on most bookshelves
MI29a	A1	Must allow people in wheel chairs access to books
MI29b	A1	Must be able to reach at least 6 ft
MI29b	A1	Has to follow safety requirements
MI29b	A1	Has to be easy to use (convenient)
MI29b	A1	Must operate smoothly
MI29b	A1	Must not damage the books
MI29b	A1	Must be able to grab books and bring them down
MI29b	A1	Must be accessible by a person in a wheelchair
MI29b	A1	Mechanism must be simple enough to adjust to most existing bookshelves
MI29b	A1	Must be able to carry the heaviest books on the bookshelf

MI29b	A1	Must be able to grab the thinnest to the thickest book on the bookshelf
MI29b	A1	Must be far away enough from the user during operation to ensure the safety of the user
MI29b	A1	Must be a mounted design attached to the bookshelf
LA03	A1	Mechanical- slide rail on bookshelf
LA03	A1	Mechanical graper attached to slide rail
LA03	A1	Adjustable plates used for clamping on book
LA03	A1	Base plate for bottom of book
LA03	A1	Grip handle with ability to squeeze like a brake on a bike
LA03	A1	Long shaft attached to plates and handle movable on slide rail
LA03	A1	Electric- could be electric, in that case electrified slide rail
LA03	A1	Actuating buttons for mechanisms if electric
LA03	A1	Contains same material as mechanical device
SO05	A1	Be usable in a wheel chair
SO05	A1	Be able to safely retrieve books
SO05	A1	More than 6" high off the ground
SO05	A1	Operate smoothly
SO05	A1	Does not damage books
SO05	A1	Not complex
SO05	A1	Able to be installed on existing bookshelves
SO05	A1	Must be easy to use
KU92	A1	Must be lightweight strong
KU92	A1	Battery operated or manually
KU92	A1	Free of sharp edges
KU92	A1	No pinch zones
KU92	A1	Mechanism must be developed to hold books securely
KU92	A1	Proper gearing should be used so the mechanism doesn't go too fast or slow
KU92	A1	Make it foldable
KU92	A1	Must be able to be stored somewhere on the chair
KU92	A1	Possibility to make this device useful for other objects (Pots)
KU92	A1	Don't want use a material that will harm books or wood or plastic shelves
KU92	A1	Light that turns on and off to let the user know that the books are secure
LA22	A1	Device must be safe to use
LA22	A1	Must be convenient
LA22	A1	Smooth operation
LA22	A1	Books unharmed
LA22	A1	Simple design
LA22	A1	Installed on most existing book shelves
LA22	A1	Wheel chair accessible
LA22	A1	Reach 6+ ft
LA22	A1	Must be interfaced for those with various PIS abilities
LA22	A1	Cost efficient
LA22	A1	Ability to be packaged and transported
LA22	A1	Minimal maintenance
LA22	A1	Reliable
SA04	A1	Safe
SA04	A1	Convenient
SA04	A1	Operate smoothly
SA04	A1	Not damage books
SA04	A1	Relatively simple
SA04	A1	Able to be installed on most existing bookshelves
SA04	A1	Grab books at 6 ft or above
RE05	A1	Movable
RE05	A1	Safe to use
RE05	A1	No sharp edges
RE05	A1	Prevents user from injury
RE05	A1	Convenient
RE05	A1	Simple mechanism
RE05	A1	Retrofit to any bookshelf
MA08	A1	Must grasp books tightly
MA08	A1	Must be quiet enough for library settings
MA08	A1	Needs to operate without overheating or adding excessive heat to environment
MA08	A1	Must reach at least 10 ft high
MA08	A1	Must be easy to access with a wheelchair
SU14	A1	Safe-no harm to user, others, objects (bookshelf)
SU14	A1	No damage to books
SU14	A1	Operate smoothly
SU14	A1	Convenient - easy to operate
SU14	A1	Can reach height of 6+ feet
SU14	A1	Easy installation
SU14	A1	Accurate-selecting correct book
SU14	A1	Gets 1 book at a time
SU14	A1	Out of the way in the aisle
SU14	A1	Adjustable for size of book
SU14	A1	Fairly quick at getting book down
SU14	A1	Able to identify book or particular location of book
SU14	A1	Inexpensive
SU14	A1	Adjustable attachment for where to put device for different size bookshelves

SU14	A1	Able to be controlled by someone in wheelchair
SU11B	A1	Safe to use
SU11B	A1	Convenient operation/use simple interface
SU11B	A1	Smooth/consistent motion
SU11B	A1	Universal to all types of bookshelfs
SU11B	A1	Adjustable to grab different size books
SU11B	A1	Capable of reaching books 6+ feet
SU11B	A1	Mechanism that is operable by people in wheel chairs with different disabilities
SU11B	A1	Grabbing motion must not damage books
SU11B	A1	Mechanism strong enough to carry heavy books
SU11B	A1	Easily installed on existing bookshelfs
TE27	A1	Must extend beyond 6 ft
TE27	A1	Must be operable from wheelchair user height
TE27	A1	Must be able to grab a book
TE27	A1	Must pass ANSI safety standards
TE27	A1	Must not damage books
TE27	A1	Must be automated so users do not have to exert force
TE27	A1	Must weigh less than 50 lbs so it can be installed on bookshelves
TE27	A1	Must operate in a smooth manner without jerking
TE27	A1	Must cost less than $100
JA04b	A1	Must be capable of reaching books from 4 ft to >6ft
JA04b	A1	Must be safe for anyone to operate
JA04b	A1	Must be wheelchair accessible
JA04b	A1	Must be able to be integrated for use with ~most~ bookshelves
JA04b	A1	Simple to use: friendly user interface, not too many buttons, easy to grasp without excessive instruction
JA04b	A1	Must move at a moderate pace and only apply a small fore to keep books from being damaged
JA04b	A1	Must apply enough force/maintain grasp well enough that book stays within mechanism's grasp
VI10	A1	Must reach above 6 ft
VI10	A1	Can't allow falling hazard possibilities from falling books
VI10	A1	Must not damage books on retrieval
VI10	A1	Must be able to store easily
VI10	A1	Must be able to assemble quickly/easily
VI10	A1	Must be able to operate in one standard motion
VI10	A1	Must allow for versatile/adjustable installation (for different shelves)
VI10	A1	Must require hand-use only
VI10	A1	As lightweight as possible to avoid off balancing bookshelves
VI10	A1	Needs to be able to be used on different shelves quickly/easily
VI10	A1	Needs to be able to grab different sizes of books
VI10	A1	Quiet operation
MI09	A1	It must be able to grab books from 6 ft or above
MI09	A1	It must be safe to use
MI09	A1	It must be a mechanism
MI09	A1	It must operate smoothly
MI09	A1	It must not damage the books
MI09	A1	It must be easy to use
MI09	A1	It must be easy to uninstall
MI09	A1	It must be able to hand the book off
MI09	A1	It must be able to bring the book down to 3 ft (wheelchair level)
MI09	A1	It must be able to be installed in most existing bookshelves
MI09	A1	It must be able to grab any size book
MI09	A1	It must not damage the books off of the shelf
MI09	A1	It must be quiet when in use
MI09	A1	It must be able to be controlled by a user in a wheelchair
AN24	A1	Wheelchair accessible
AN24	A1	Must be able to reach above 6 ft
AN24	A1	Cause no damage to books
AN24	A1	No pinch points
AN24	A1	Little force necessary
AN24	A1	Lightweight
AN24	A1	Low friction on mechanism
AN24	A1	Strong enough to hold books
AN24	A1	Not vertical
AN24	A1	Long enough to allow user to see book
AN24	A1	Must bring book to user
AN24	A1	Can be used by people of all sizes
AN24	A1	Can be used by people of all ages
AN24	A1	Can be maintained by library employees
DI15	A1	No pinch points
DI15	A1	Operable with one hand
DI15	A1	Reliable
DI15	A1	Lightweight (less than 20 lbs)
DI15	A1	Cheap to manufacture
DI15	A1	Takes less than 45 min to install
DI15	A1	Can lift at least 10 lb
DI15	A1	Can put books back
DI15	A1	Can only extrude 3" from bookshelf
DI15	A1	Does not require much grip strength from user

DI15	A1	Little to no power required (12V or less)
DI15	A1	Can be used by children and elderly
DI15	A1	Does not damage bookshelf
DI15	A1	No sharp edges
MA22	A1	Must reach at least 6 ft
MA22	A1	No pinch points
MA22	A1	Must not damage books
MA22	A1	Must be relatively quiet
MA22	A1	Must be easily installed
MA22	A1	Must leave an appropriate amount of walking room in the aisles
MA22	A1	Must satisfy safety standards
MA22	A1	Must be able to be installed on a wide range of bookcases
GI17	A1	Must have rails on sides to prevent any falls
GI17	A1	Platform must not be slick
GI17	A1	Needs to hold up around 500 lbs or more
GI17	A1	Easy to use
GI17	A1	Must extend to the highest bookshelf
GI17	A1	Can't block pathways in between shelves
GI17	A1	Should not exert much effort to use
AM05	A1	Light enough to pick off the flage while sitting
AM05	A1	Not made of hazardous material
AM05	A1	Not overly loud
AM05	A1	Strong enough to pick up heavy books (dictionaries)
AM05	A1	Easy to manufacture
AM05	A1	No sharp edges
AM05	A1	Must be operable with mostly one hand (other on wheelchair)
AM05	A1	Compatible with multiple size books and shelves
LI04	A1	Simple user interface
LI04	A1	Not interfere with normal library use
LI04	A1	Quiet
LI04	A1	Doesn't harm books
LI04	A1	Reliable
LI04	A1	Easy maintenance
LI04	A1	Inexpensive so multiples can be made
LI04	A1	Must be able to be operated by someone in wheelchair
LI04	A1	Must get books from shelf and bring to lower level
LI04	A1	Powered by 110 V outlet
LI04	A1	Adjustable to fit on different sized bookshelf
LI04	A1	Lightweight
LI04	A1	Easy installation
RE08	A1	Safe to use
RE08	A1	Operate smoothly
RE08	A1	Not damage books
RE08	A1	Simple
RE08	A1	Installed on most existing bookshelves
RE08	A1	Grab books
RE08	A1	Reach 6 feet from seated position
RE08	A1	Convenient to use
RE08	A1	Be a mechanism
GE08	A1	Assembly should be convenient/easy to use
GE08	A1	Assembly should not damage books
GE08	A1	Assembly should be safe
GE08	A1	Assembly mechanism must be smooth (movements)
GE08	A1	Assembly should be relatively simple
GE08	A1	Assembly must be able to be installed on most existing bookshelves
GE08	A1	Assembly should be wheelchair friendly (can be operated from ~3 ft)
GE08	A1	Mechanism must lower books from highest level of bookshelf (+6ft) to wheelchair level (~3ft)
GE08	A1	Mechanism must be able to grab and release books
MA15	A1	Safe to operator
MA15	A1	Safe to bystanders
MA15	A1	Safe to books
MA15	A1	Smooth operation
MA15	A1	Ability to retrieve book from highest shelf
MA15	A1	Ability to deliver book to individual sitting without use of legs
MA15	A1	Ability to work with all size/weight/thickness of books
MA15	A1	Installed on bookshelf
MA15	A1	Convenient to use
MA15	A1	Design should be adaptable to most bookshelves
MA15	A1	Not complicated i.e electronic, power requirements
CH05	A1	People in wheel chairs must not be able to grab books 6 ft and above on shelves
CH05	A1	Must be safe to use
CH05	A1	Must not damage books
CH05	A1	Must be universal, able to be used on different types of bookshelf
CH05	A1	Should be simple
CH05	A1	Must be easy to use
CH05	A1	Must be adaptable for different bookshelf/books
CH05	A1	Must be able to grab different size books

VI20	A1	Must work for 6 ft or above
VI20	A1	Must meet safety requirements
VI20	A1	Must help people in wheel chairs reach books on top of bookshelfs
VI20	A1	Must not cause damage to environment around it
VI20	A1	Must be able to be installed on most existing bookshelves
VI20	A1	One person to operate
VI20	A1	Installed in wheelchair accessible locations
CH06	A1	Safe to use
CH06	A1	Operate without damaging books
CH06	A1	Able to install on existing bookshelves
CH06	A1	Must grab books from 6 ft and above
CH06	A1	Convenient use for someone in wheelchair
CH06	A1	Cost efficient
CH06	A1	Delivery and time
MA10	A1	The device must not require much force to operate
MA10	A1	The device must be a clamp that will not damage books
MA10	A1	The device must be lightweight because people in wheelchairs may have disabilities that are limiting
JU22	A1	Must be safe for user
JU22	A1	Must be safe for non-users
JU22	A1	Must allow user to reach the top shelf (>6ft)
JU22	A1	Must be able to be used by handicapped/wheelchaired person
JU22	A1	Must be compact
JU22	A1	Must be able to be stored away when not in use
JU22	A1	Cannot damage books
JU22	A1	Must be compatible with most bookshelves (>95%)
JU22	A1	Ideally, can be installed with little/no tools
JU22	A1	Requires minimum effort of user
JU22	A1	Potentially be able to grab other things besides books
JU22	A1	Easy to assemble (No assembly)
JU22	A1	Installed without expertise
JU22	A1	One hand operation
JU22	A1	Low profile visually in room
JU22	A1	Must grab wide range of books (magazines-encyclopedia)
JU22	A1	Will support weight of person (if lifting them)
JU22	A1	Compatible with people in manual/powered wheelchairs
JU22	A1	Ambidextrous operation
ME12	A1	Must be able to be installed on most existing bookshelves
ME12	A1	Must be able to be able to be conveniently used from a wheelchair
ME12	A1	Must be safe to operate
ME12	A1	Must not damage the books in any way
ME12	A1	Must be able to be used on the highest shelf (6ft or above)
ME12	A1	The final assembly must be relatively simple
ME12	A1	Mechanism must operate smoothly
CH09	A1	The device must be able to grab a book
CH09	A1	The device must be able to move a book
CH09	A1	The device must be able to lower a book
CH09	A1	The device must be able to release a book
CH09	A1	The device must be able to be used by people in wheelchairs, easily
CH09	A1	The device must be safe for the user at all times during use and when not being used
CH09	A1	The device should be able to maneouvre books of different sizes
CH09	A1	The device must be able to pick up and move books from a shelf at 6 ft or higher
CH09	A1	The device should be safe for the environement in which it is stationed
CH09	A1	The device must be able to be placed by or attached to a bookshelf
CH09	A1	The device must not damage books during use
CH09	A1	The device should be relatively simple to install on bookshelves
CH09	A1	The device should be able to work on most bookshelves
KI12	A1	Must be able to reach at least 6 ft from the floor
KI12	A1	Comply with appropriate safety standards
KI12	A1	Must not damage any book, "defined as any damage that decreases the monetary worth" of the book
KI12	A1	Must be able to be fixed around/on any common bookshelf, or portable
KI12	A1	Must be able to obtain book within 1 minute
KI12	A1	Must not require more than 3 pounds of user input to operate
KI12	A1	Must be able to be operated by one person alone
KI12	A1	Cannot damage the bookcase, " "
KI12	A1	Must operate below a X decibel noise level
KI12	A1	No pinch points
KI12	A1	No sharp points
DE15	A1	Safe
DE15	A1	Convenient
DE15	A1	Smooth movements
DE15	A1	Easily installed
DE15	A1	Range of 1.5-2 ft from ground level to 6'
DE15	A1	Easily accessible with wheelchair
DE15	A1	Able to hold different thickness of books
DE15	A1	Able to hold wide range of weights of books
DE15	A1	Soft grippers to not damage book cover
LI04b	A1	Must be safe for all persons to use

LI04b	A1	Must be convenient
LI04b	A1	Must operate smoothly
LI04b	A1	Must not damage books
LI04b	A1	Set-up must be simple
LI04b	A1	Must be adjustable so can be installed on most existing bookshelves
LI04b	A1	Must not require large exertion from user (<5lbs force)
LI04b	A1	Must reach at least 6'
LI04b	A1	Must be compatible with wheelchair users
LI04b	A1	Must be quiet
LI04b	A1	Must not block access to other bookshelves
LI04b	A1	Must be aesthetically pleasing for most library settings
LI04b	A1	Must withstand many uses
LI04b	A1	Must not damage bookshelves
LI04b	A1	Must be able to work with many different sized/shaped books
LI04b	A1	Must be usable for non-wheelchair persons
LI04b	A1	Must be affordable for the general public
JO24	A1	Low to no strength by person using mechanism
JO24	A1	Make little to no noise
JO24	A1	Operate at a safe speed
JO24	A1	Easy install
JO24	A1	Reach books from 0 to 6 ft
JO24	A1	Make the mechanism accessible to people in wheelchairs
AN18	A1	Must be able to grab books of shelves 6 ft and above (need max height here)
AN18	A1	Must not damage books
AN18	A1	Must be compatible with existing bookshelf designs
AN18	A1	Must be able to be used from a wheelchair
AN18	A1	Must be safe (need to be more specific)
AN18	A1	Must be convenient (also needs to be more specific)
AN18	A1	Must be able to operate smoothly (also really vague, not a good requirement)
ME25	A1	Safe to use
ME25	A1	Convenient
ME25	A1	Not damage the books
ME25	A1	Simple design
ME25	A1	Must attach to bookshelves
ME25	A1	Must be adjustable/come in different sizes
ME25	A1	Must be easy to install
ME25	A1	Intuitive design-easy to use
ME25	A1	Relatively cheap production to place on every shelf
ME25	A1	Easy to make
ME25	A1	Relatively small
ME25	A1	Strong enough to lift a variety of books (max 10+lbs, maybe 20)
ME25	A1	Must be quiet
ME25	A1	Must have consistent strong grip without causing damage
VI01	A1	Be safe
VI01	A1	Having gripping handle with grip range 1/4" to 4"
VI01	A1	Inside surface of grippers should be soft but have a c.o.f. enough to grab book
VI01	A1	Mount to most bookcases
VI01	A1	Be light (<5lbs)
VI01	A1	Extend to a full length of at least 6 ft (vertically)
VI01	A1	User's end should be about 3 ft high off ground (aka in easy reach of wheelchair without much extension)
MA12	A1	Safe to use, no injury during use
MA12	A1	Convenient, easily accessible
MA12	A1	Operate smoothly, no breaking or jamming
MA12	A1	No damage to books
MA12	A1	Simple design for most bookshelves
MA12	A1	At 6 ft above or any height not accessible
MA12	A1	Relatively inexpensive
MA12	A1	Not too heavy for easy lift
MA12	A1	Easy production and construction
MA12	A1	Adjustable for different people
MA12	A1	Easy to store
MA12	A1	Adjustable for bookshelves
MA12	A1	Does not damage bookshelves
MA12	A1	A way to self support if necessary
KA02b	A1	Safe for user
KA02b	A1	Safe for surrounding people
KA02b	A1	Lightweight (not require >15lbf)
KA02b	A1	Easy to manipulate (not top heavy/hard to hold)
KA02b	A1	Easy to use (simple or no instructions)
KA02b	A1	Smooth/soft grippers for books
KA02b	A1	Easy to install/assemble
SA04b	A1	It must reach 6 feet
SA04b	A1	It must be a mechanism
SA04b	A1	It must be safe to use
SA04b	A1	It must be safe to set up
SA04b	A1	It must be safe to diassemble
SA04b	A1	It must be convenient

SA04b	A1	It must be easy to use
SA04b	A1	It must operate smoothly
SA04b	A1	It must be consistent
SA04b	A1	The books must not be damaged
SA04b	A1	It must allow the user to stay in place during use
SA04b	A1	It must be light enough to not tip over the bookshelf
SA04b	A1	It must not involve foot pedals
SA04b	A1	It must be able to pick up many sizes of books
SA04b	A1	It must stop once someone blocks the path of the mechanism
JA04	A1	Shall support 500 pounds
JA04	A1	Shall be 2x size of standard wheelchair
JA04	A1	Shall be installed on gliding track
JA04	A1	Shall be powered with hydraulic system
JA04	A1	Shall be able to be operated by both handicapped/non-handicapped
JA04	A1	Shall rise 3 ft high
JA04	A1	Shall have basket for books
JA04	A1	Shall have inclined entry point
JA04	A1	Shall have guard rails on 3 sides
JA04	A1	Shall have secured gate on entry side
JA04	A1	Shall not show fingerprints or other day-to-day wear and tear
JA04	A1	Shall be operated by single joystick
JA04	A1	Shall allow patrons to access shelves if not operating mechanism
SU08	B2	Should be small enough to not interfere with riding when not in use (smaller than 4''x4'')
SU08	B2	Must remain fixed to bike unless purposely removed by user (locking mechanism perhaps)
SU08	B2	Should be able to withstand basic theft situation i.e. assault via hand tools and 100ish lbs of pulling force on bike
SU08	B2	Should not require any power
SU08	B2	Should be a sturdy lightweight material
SU08	B2	Should be easily operated by an eight year old
SU08	B2	Must not have pinch points or other hazards for the user
SU08	B2	Should be aesthetically pleasing: possibly a variety of colors to match different bikes or chrome finish
SU08	B2	Must be able to be installed with easily available hand tools
SU08	B2	Should be able to be maintained by the average cyclist
SU08	B2	Must cost less than replacing a stolen bike
MA11a	B2	Must secure bike
MA11a	B2	Must not fall off while riding
MA11a	B2	Must be able to be easily removed
MA11a	B2	Must not interfere with rider
MA11a	B2	Must be less than $50
MA11a	B2	Material must be sufficient to provide longevity and lightness
MA11a	B2	Must be easy to lock and unlock
MA11a	B2	Must be able to withstand bolt cutters
MA11a	B2	Must be cheap enough to manufacture to assure sufficient profit margin
MA11a	B2	Must be completed by xx date
MA11a	B2	Must provide positive feedback when lock is secured
MA11a	B2	Must be pleasant to look at
SH21	B2	Inexpensive ($20 or under)
SH21	B2	Light weight (3lbs at most)
SH21	B2	Made of a strong material to withstand external forces
SH21	B2	Material that can withstand elements (corrosion)
SH21	B2	Should not make noise while riding the bike
SH21	B2	Permanently fastened to bicycle
SH21	B2	Removable and adjustable
SH21	B2	Made of a lightweight material
SH21	B2	Must have a way of unlocking (code or key)
SH21	B2	Designed so it can be easily adjustable for locations around the bicycle
SH21	B2	No maintenance
SH21	B2	If it is a dial lock, easy to turn
SH21	B2	Comes assembled when bought
AL14	B2	Must be able to close and be locked
AL14	B2	Must stay attached to bike after unlock
AL14	B2	Must be simple enough to use that a child can operate it
AL14	B2	Must be light enough so that it does not alter the bikes efficiency
AL14	B2	Must be able to withstand a force great enough not to be pulled off by a robber
AL14	B2	Must have a small dimensional analysis so that it does not interfere with operator on bike
AL14	B2	Must be safe to use not harming anybody
AL14	B2	Material must have properties that reflect cost, strength, and safety
AL14	B2	Must be cost effective to turn a profit
AL14	B2	Must be easily repairable or replaced
AL14	B2	Must have kill switch in case of issue
AL14	B2	Must be able to last a multitude of lock/unlock sequences
AL14	B2	Must be engineered to be created in bulk
AL14	B2	Must be made with as little components as possible
KR20	B2	Lock should not exceed width of bike frame
KR20	B2	Lock should be made of nonoxidizing material
KR20	B2	Should be under 3 lbs
KR20	B2	Can be removed
KR20	B2	Can be placed on multiple parts on bike

KR20	B2	Should not move when attached
KR20	B2	Should be able to resist forces when bike rides over bumps
KR20	B2	Should be casted to improve cost
KR20	B2	Should be able to stay on in a crash or if bike falls over
KR20	B2	No sharp edges
KR20	B2	Lock can be held with one hand
KR20	B2	Must click when lock secured
KR20	B2	Must cost less than $5 to make
MI18	B2	Small and compact (~size of a phone in footprint)
MI18	B2	Low profile (~1" in width on either side of bike)
MI18	B2	Lightweight (~1-2lb total weight)
MI18	B2	Locking mechanism onto bike frame that can be removed or adjusted with security screws
MI18	B2	Retractable design to conceal entire lock with retracting cable at least 5mm in diameter
MI18	B2	Spring loaded to retract when unlocked
MI18	B2	Withstand moderate wire/bolt cutters
MI18	B2	Having strong tensile strength (~500lbs)
MI18	B2	Use non corrosive materials, abs plastic shell, stainless steel cable and housing
MI18	B2	Cart dispense cable when riding
MI18	B2	Non invasive to steering or pedaling
MI18	B2	Low profile design to prevent knees or legs from hitting it overall (~6-7" write including frame)
MI18	B2	Low production cost ~$15
MI18	B2	Selling price under $50
MI18	B2	Does not damage frame permanently if removed
MI18	B2	Minimal maintenance, cleaning, oil occasionally
MI18	B2	One single cable design, just lock the cable ends together for strength
MI18	B2	Simply activated, pull out cables to length and ratchet system stops when letting go, extend again to retract
KA10	B2	Lock must be small enough to fit on the bike
KA10	B2	Lock must fit a large variety of bikes
KA10	B2	Multiple mounting locations are preferred
KA10	B2	Should be able to operate with one hand
KA10	B2	Must withstand impacts with branches or rocks
KA10	B2	Must be waterproof
KA10	B2	Should have some resistance to UV light
KA10	B2	Should be constructed from a lightweight material
KA10	B2	Should indicate when the lock has been fully engaged
KA10	B2	Must not get in the way of normal bike operation
KA10	B2	Must be resistant to shiming and picking
KA10	B2	Must resist cutting/sawing attacks
KA10	B2	Must last at least 2 years
KA10	B2	Must be free of sharp edges
KA10	B2	Should be made from less than 5 components
KA10	B2	Should be easy to assemble that a 5th grader can do it
KA10	B2	Should withstand abrasion from mud and sand
MA11b	B2	Geometry: Able to attach to frame of bike
MA11b	B2	Geometry: Small enough to not obstruct use of bike
MA11b	B2	Kinematics: limited to the minimum degrees of freedom needed to operate as a lock
MA11b	B2	Kinematics: Firmly attaches to bike
MA11b	B2	Forces: Able to withstand strength of full grown adult man trying to pull it open
MA11b	B2	Material: Material must be lightweight enough to be noticible by bike rider
MA11b	B2	Material: Material must withstand longterm outdoor exposure (min 5 years)
MA11b	B2	Signal: must visually display if locked/unlocked
MA11b	B2	Safety: No obvious pinch points or sharp edges
MA11b	B2	Ergo: easily usable by average child
MA11b	B2	Ergo: usable by a person wearing gloves
MA11b	B2	Ergo: easy to roe in wet conditions
MA11b	B2	Production: Part must be adaptable to multiple types of bikes
MA11b	B2	Quality control: Lock must act smoothly and repeatably
MA11b	B2	Operation: Lock must act smoothly and repeatably
MA11b	B2	Operation: Must take less than 10 seconds to lock bike up
MA11b	B2	Operation: Less than 10 minutes to install
MA11b	B2	Maintenance: No maintenance during life cycle
MA11b	B2	Recycling: Made from standard metals and plastics that can be reused/recycled
MA11b	B2	Costs: End user cost <= $30
ME11	B2	The lock shall not be capable of being removed from the bike without significant and/or sophisticated tools
ME11	B2	The lock shall mount flush with the frame of the bike such that it does not stick out
ME11	B2	The lock shall not hit the knees of the rider
ME11	B2	The lock should not slow the rider down by more than 5 seconds over a 500ft. Climb (all other variables constant)
ME11	B2	The bike lock shall be manufactured out of material that is not extremely expensive
WE31	B2	Safety lock must weigh <2lbs
WE31	B2	Safety lock must be able to get wet (can't rust)
WE31	B2	Safety lock must not lose material qualities in weather that is 0 degree F <= T <= 105degrees Farenheit
WE31	B2	Safety lock must cost <$8 to make, including labor cost per part
WE31	B2	Safety lock must not have sharp edges
WE31	B2	Safety lock must not damage bike when attached
WE31	B2	Safety lock must be <= 6"x2"x2"
WE31	B2	Safety lock must match a color of the bike (should not stand out)
WE31	B2	Safety lock be strong (yielding strength = ? Maybe 500 lbs ?

WE31	B2	Safety lock must not get in the user's way during pedalling
BE02	B2	Must not be able to be broken off
BE02	B2	Weight under 5 lbs
BE02	B2	Cost less than $10
BE02	B2	Can be removed/adjusted when not in use
BE02	B2	Fit within a 3"x3"x3" box
BE02	B2	Installed in less than 3 min
BE02	B2	No sharp edges that could impale cycler during wreck
BE02	B2	Visually complementing to the bike
LA04	B2	Cost <$50
LA04	B2	Weight < 100lbs
LA04	B2	Stored in a closet
LA04	B2	Don't injure rider
LA04	B2	Manufactured for <$10 per part
LA04	B2	Must have less than 10 components (not including lock components)
LA04	B2	Must be easily usable by people with large hands
LA04	B2	Must resist 1 KN of destructive force
LA04	B2	Must be able to fold burritos
LA04	B2	Components must be recyclable
LA04	B2	Thrust resistant
LA04	B2	Durable
LA04	B2	Tough
LA04	B2	Doesn't break ears
LA04	B2	Titanium?
LA04	B2	Silent
LA04	B2	No sharp edges
LA04	B2	Has a basic understanding of algebra
MI02	B2	Secure the bike
MI02	B2	Light weight (2lbs)
MI02	B2	Inexpensive <$25
MI02	B2	Attachment capability
MI02	B2	Small
MI02	B2	Non-obtrusive when riding
MI02	B2	Long-lasting
MI02	B2	Durable
MI02	B2	Rust resistant
MI02	B2	Strong
MI02	B2	Low to no maintenance/upkeep
MI02	B2	Theft resistant
MI02	B2	Metal
MI02	B2	Easy to assemble
MI02	B2	Capable of being removed
MI02	B2	User-friendly
MI02	B2	No sharp edges
PA27	B2	Non obtrusive to bicycle (size)
PA27	B2	Permanently fastened
PA27	B2	Material properties to prevent theft
PA27	B2	Removable/adjustable
PA27	B2	Inexpensive to produce
PA27	B2	Long-lasting
PA27	B2	Locks bike
PA27	B2	Does not interfere with bicycle function when not in use
PA27	B2	Safe when bicycle is in use
NA21	B2	Compact size - should not be bigger than the bike handles
NA21	B2	Safety lock is easily accessible by hands when riding
NA21	B2	Fastening mechanism can be tightened and loosened
NA21	B3	Fastener goes around the whole bike handle for increased friction
NA21	B2	Fastener or safety lock cannot have sharp edges
NA21	B2	All components should be rust resistant
NA21	B2	Safety lock should be able to stop bike
NA21	B2	Fastener can be attached to multiple components of bike
NA21	B2	Material slowing down bike speed can't be flammable
NA21	B2	Fastener can handle dirt and rocks hitting it and not break
NA21	B2	Bike lock should be different color than bike handles
MI29	B2	Must be a bike lock
MI29	B2	Must not be able to be removed during use
MI29	B2	Must be relatively inexpensive
MI29	B2	Must not get in the way during riding
MI29	B2	Can adjust or remove when not in use
MI29	B2	Must be lightweight strong
MI29	B2	Must be easy to use
MI29	B2	Must withstand a lot of force
MI29	B2	Relatively small
MI29	B2	Can withstand repeated unlocking and locking
MI29	B2	Easy to unlock/lock
ML02	B2	Made of Carbon Steel
ML02	B2	Less than 4"x4" footprint

ML02	B2	Opened with key
ML02	B2	Withstand 500 lb tensile force
ML02	B2	Cost less than $5 to manufacture
ML02	B2	Sell less than $25
ML02	B2	Must be a U shape with locking mechanisms on both ends
ML02	B2	Must be coated to resist rust
ML02	B2	Must have easy to use instruction manual
DA02	B2	Drag effects must be negligibile
DA02	B2	Must be secure on bike while in motion
DA02	B2	A five year old should be able to use it
DA02	B2	The process required for its use should be logical and intuitive
DA02	B2	Must improve upon related products
DA02	B2	Materials must be durable
DA02	B2	Can be used with a multitude of different bikes
DA02	B2	Simple, yet secure
DA02	B2	Little maintenance required
DA02	B2	Must be safe
DA02	B2	Can be used by a tired bicyclist
KI01	B2	Install with only one tool
KI01	B2	Less than $40
KI01	B2	Fits around most bike racks
KI01	B2	No sharp edges
KI01	B2	Option of either key or code
KI01	B2	Weigh less than 2 pounds
KI01	B2	Won't rust when left outside
KI01	B2	Locks are tamper-resistant
KI01	B2	Cannot easily be cut with bolt cutters
KI01	B2	Unobtrusive on bike while not in use
KI01	B2	Only metal, no plastic parts
KI01	B2	No maintenance
KI01	B2	Uses a pre-assembled lock cylinder
KI01	B2	Stays unlocked even after key is removed
KI01	B2	Smaller than 10"x3"x3"
LI11	B2	Stay attached to bicycle during use
LI11	B2	Durable
LI11	B2	Adjustable
LI11	B2	Removed if needed
LI11	B2	Non-obtrusive to bicyclist
LI11	B2	Weigh less than 10 lbs
LI11	B2	Cost under $30
LI11	B2	Small size compared to bicycle
LI11	B2	Be able to lock bicycle
LI11	B2	Anyone could use it
LI11	B2	Able to be mass produced
LI11	B2	No sharp edges/corners
LI11	B2	Waterproof
LI11	B2	Able to use on different styles of bicycles
LI11	B2	Match bicycle styling
JA12	B2	Light weight <12 oz
JA12	B2	Removable but securely fastened
JA12	B2	Impact resistant
JA12	B2	Water/corrosion resistant
JA12	B2	Inexpensive/on par with other locks; sell for ~10-20
JA12	B2	Does not impede user of bike while riding
JA12	B2	Install in <5 minutes
JA12	B2	Deploy in < 1 minute
JA12	B2	Able to lock securely when deployed; can't be pulled open easily
LA11	B2	The lock must fall within geometric requirements
LA11	B2	Lock must remain secure during riding
LA11	B2	Lock must withstand bolt cutters
LA11	B2	Lock must be < 1lb
LA11	B2	Lock must cost < $20
LA11	B2	Must have a lifetime equal or greater than the bike
LA11	B2	Lock must be easily removed
LA11	B2	Lock must secure frame and front wheel of bike
LA11	B2	Must be easy for user to assemble with common tools
LA11	B2	Must have a secure method of locking, unlocked only by owner
LA11	B2	No maintenance
LA11	B2	Must signal user when property locked
LA11	B2	Corrosion resistant
LA11	B2	Must be operational -10degreeF< temp <100 degree F
LA11	B2	Lock cannot be broken with hands
LE08	B2	Same size as bike sint
LE08	B2	Must have loop to lock onto other object
LE08	B2	Must be able to swivel from back of bike sent to side
LE08	B2	Must not worsen aerodynamic performance
LE08	B2	Must be able to withstand force of human grip/pull

LE08	B2	Lock must not break off when yanked/hit
LE08	B2	Must be made of light material
LE08	B2	Must be made of cheap material
LE08	B2	Must be reflective for identification in the dark
LE08	B2	Must have slot for key or number code
LE08	B2	Must not interfere with pedals
LE08	B2	Must lock in place after repositioning
LE08	B2	Must be rigid
LE08	B2	Must contain less than five subcomponents
LE08	B2	Must not rust
LE08	B2	Must not be cuttable with pliers/wire cutters
LE08	B2	Must detach from bike
LE08	B2	Must blend in with bike's aesthetic
LE08	B2	Must be made of recycled metal of plastic
LE08	B2	Must be manufactured with above minimum wage labor
CH01	B2	Must safety
CH01	B2	Must remain attached to bike
CH01	B2	Must be able to be removed/repositioned
CH01	B2	Must be unobtrusive to rider
CH01	B2	Must weigh less than 2 lbs
CH01	B2	Must cost less than $40
CH01	B2	Should prevent bike theft if user wanted to
CH01	B2	Should prevent front tire theft if user wanted to
CH01	B2	Should be able to last 2-3 years in the elements
CH01	B2	Should attach to most (90%)currently produced bicycles
CH01	B2	Should not detract from bike aesthetics
CH01	B2	Must not cause damage to bicycle under normal use
KA02	B2	Must lock securely
KA02	B2	Lock must withstand 500 lbs pulling force
KA02	B2	Lightweight (<7lbs)
KA02	B2	Cost must be less than $30
KA02	B2	Lock must be weather resistant
KA02	B2	Lock must not damage bike
KA02	B2	Lock should fit dimensions 8"x20"x2"
KA02	B2	Lock must conform to safety standard xxx for bike locks
KA02	B2	Lock should require minimal maintenance
KA02	B2	All internal components should be unaccessible to prevent tampering
KA02	B2	Lock should be able to fit "common brand" of bikes
KA02	B2	Lock must prevent theft or unauthorized use of bike
KA02	B2	At end of life, all components of the lock should be recyclable by common means
KA02	B2	Lock should audibly let the user know when it has engaged
KA02	B2	Lock should be simple to unlock by the user but tamper resistant and difficult to remove by unauthorized user
SH16	B2	Must be attached to the bike
SH16	B2	Must last for at least 3 years
SH16	B2	Must be removable
SH16	B2	Must be adjustable for all bicycles
SH16	B2	Must be lightweight (<5lbs)
SH16	B2	Must be inexpensive (<$20)
SH16	B2	Must not interfere with riding the bike
SH16	B2	Must be sturdy enough to withstand impact/forces (sigma>=)
SH16	B2	Should not look like a piece of shit (aesthetically pleasing)
SH16	B2	Must reach what it is locked to (for example chain length >=1m)
SH16	B2	Should not contain many parts (easy assembly)
SH16	B2	Should come in different color options (black, gray, white, red, blue)
SH16	B2	Should have large parts (not easily broken)
SH16	B2	Must be legal in all 50 states
SH16	B2	Must be waterproof (weatherproof)
BA25	B2	Last for more than 5 yrs of everyday use
BA25	B2	Has a permanent location on the bike
BA25	B2	Can be removed if necessary (with the key/code)
BA25	B2	Cost less than $30
BA25	B2	Should not affect the biker while using the bike
BA25	B2	Weigh less than 5lbs
BA25	B2	Cannot be broken with hands alone
BA25	B2	Resistant to weather damages
BA25	B2	Waterproof
BA25	B2	Is not defective in more than 1 per 1000 units
BA25	B2	Cannot easily harm the user
BA25	B2	Cost more than $5
BA25	B2	Takes less than 20 min to install
BA25	B2	Dust resistant
JE11	B2	Should be resistant to picking
JE11	B2	Should be small
JE11	B2	Shouldn't interfere with rider/bike itself
JE11	B2	Should be removed easily by owner
JE11	B2	Should be unlocked easily by owner
JE11	B2	Should be relatively inexpensive

JE11	B2	Shouldn't require user assembly
JE11	B2	Should last a long time
JE11	B2	Should not rust
JE11	B2	Should not require maintenance
JE11	B2	Should not pinch user
JE11	B2	Should be in easily accessible location
JE11	B2	Should be on frame so it cannot be removed by theives easily
JE11	B2	Should be resistant to impacts
JE11	B2	Should be resistant to dust
JE11	B2	Should indicate if properly locked or not
JE11	B2	Should not hold up production by much
MI29a	B2	Must be a safety lock
MI29a	B2	Permanently fastened to bike
MI29a	B2	Needs to last over 5 years
MI29a	B2	May be moved/adjusted
MI29a	B2	Must be smaller than 3 lbs
MI29a	B2	Must not be obstructive to rider
MI29a	B2	Must be less than $10
MI29a	B2	Must withstand a handsaw
MI29a	B2	Material must be hard enough to not deform if beaten by hammer
MI29a	B2	Usable for all types of bikes
MI29a	B2	Usable for all ages (6+)
MI29a	B2	Must have a key slot or numbered pad unique to each one
MI29a	B2	Must require little to no maintenance (grease every year is acceptable, no more)
MI29a	B2	Assembly must be cheap (<$4)
MI29a	B2	Non-corrosive
MI29a	B2	Must keep bike from rolling when being used
MI29a	B2	Can be locked to existing fixture (i.e pole)
MI29b	B2	Must cost less than $10 to produce
MI29b	B2	Must be able to be removed by any user over the age of 12
MI29b	B2	Must weigh less than a pound
MI29b	B2	Must be smaller than 4"x4"
MI29b	B2	Must last for at least 2000 uses
MI29b	B2	Must not be able to be removed or adjusted while in the locked position
MI29b	B2	Must not be a pinch risk for the user
MI29b	B2	Must be able to withstand a force of 25 pounds
MI29b	B2	Must be made out of recycled material
MI29b	B2	Must not take more than 100 man hours to design
MI29b	B2	Must not cost more than $5000 to develop
MI29b	B2	Must not involve more than 3 manufacturing processes
MI29b	B2	Must not require any maintenance for first 500 uses
MI29b	B2	Maintenance needed after 500 uses must be able to be performed by people over the age of 12
MI29b	B2	Must be able to be packaged and stocked individually
MI29b	B2	Locking mechanism must be tested before it is sold
MI29b	B2	The lock must work with at least 25 current bike models
LA03	B2	Inexpensive
LA03	B2	Durable, longlasting metal of some sort
LA03	B2	Light weight
LA03	B2	Small in size but big enough to have a firm lock
LA03	B2	Needs special tool to remove from bike for security reasons
LA03	B2	Out of way of bikers legs
LA03	B2	Impact resistant and corrosion resistant
LA03	B2	Lock must have good internals for peak security
LA03	B2	User intuitive
LA03	B2	Must have key for person using lock
LA03	B2	Must be relatively simple in design for mass production
LA03	B2	Must be resasonable to package for shipping
LA03	B2	Must not contain hazardous components
LA03	B2	Must not have small piecesfor kids to chocke on
LA03	B2	Must be available for world wide distribution
SO05	B2	Permanently attached to bike
SO05	B2	Built to last as long as the bike
SO05	B2	Be able to remove or adjust if needed
SO05	B2	Small size when stored on bike
SO05	B2	Non-obstructive while bike is in use
SO05	B2	Light weight
SO05	B2	Low cost
SO05	B2	Function as an anti theft device
SO05	B2	Be strong enough to deter theft
SO05	B2	Be convenient to use (relative to other solutions)
KU92	B2	Lock should be made of light weight metal
KU92	B2	Lock must be able to provide a secure lock in mechanism
KU92	B2	Lock should be attached securely to the frame or finders
KU92	B2	Lock should not cost more than 100 to develop
KU92	B2	Lock should not be expensive ($20)
KU92	B2	Lock should be made of non-corrosive material
KU92	B2	Any part of the lock should not harm the rider

KU92	B2	Lock should be able to lock and unlock smoothly
KU92	B2	Lock should be "lubed" in duration to maintain the internal parts
KU92	B2	Lock must be able to be aerodynamic
KU92	B2	The lock can have small batteries to let rider know that the lock is engaged
KU92	B2	The locking bolt must be designed to withstand different kinds of forces
KU92	B2	The lock should be easy to work
KU92	B2	Ages from 5 up can use
KU92	B2	The lock should be standardized
KU92	B2	Parts should be interchangeable
KU92	B2	The lock could be automatic
KU92	B2	Debris should not be able to go into locking mechanism
LA22	B2	Design a safety lock
LA22	B2	Must be permanently fastened to bike
LA22	B2	Can be removed
LA22	B2	Can be adjusted
LA22	B2	Small and non-intrusive while riding
LA22	B2	Light weight
LA22	B2	Relatively inexpensive
LA22	B2	User friendly
LA22	B2	Durable
LA22	B2	Non-corrosive
LA22	B2	Safe
LA22	B2	Must not significantly change ride of bike
LA22	B2	Flexible for multiple bike styles
LA22	B2	Visually appealing
LA22	B2	Limited noise effect (clinking)
SA04	B2	Lasting accessory
SA04	B2	Can be removed
SA04	B2	Can be adjusted
SA04	B2	Small/non-obtrusive to rider
SA04	B2	Lightweight (<5lbs)
SA04	B2	Relatively inexpensive (<$25)
SA04	B2	Locks bike
SA04	B2	Not easily broken
SA04	B2	Works with multiple bike models
SA04	B2	Doesn't affect function of bike
SA04	B2	Safe to use
SA04	B2	Long lasting
SA04	B2	Works on multiple bike racks
RE05	B2	Must be made with corrosion resistant material
RE05	B2	Must weigh less than 5 pounds
RE05	B2	Must lock to bike frame
RE05	B2	Must contain key-lock combination
RE05	B2	Must be rigid
RE05	B2	Must be able to withstand >200 lbf at weakest location
RE05	B2	Must be ductile
RE05	B2	Must cost less than $20
RE05	B2	Must be able to fit device around object and with a surface area of at least 1.5 area of widest bike part
RE05	B2	Normal bike operation must not change due to bike device installation
MA08	B2	Should not be removable in any way without key/combination
MA08	B2	Should be resistant to extreme weather conditions
MA08	B2	Should cost no more than $20
MA08	B2	Should not interfere with spokes or any mechanism in the bike
MA08	B2	Should be relatively easy to mass produce
MA08	B2	Should be durable and withstand repeated use for 5 years
MA08	B2	Should weigh no more than 2 pounds
MA08	B2	Should not be longer than 3 inches cubed in volume
MA08	B2	Should be safe to use with minimal pinch points
SU14	B2	<$20
SU14	B2	Withstand forces/bumps
SU14	B2	Locks bicycle
SU14	B2	<5lbs
SU14	B2	Not by the pedals
SU14	B2	Easily adjustable by hand
SU14	B2	Cannot be removed by hand (stolen)
SU14	B2	Lock is sturdy and cannot be easily broken
SU14	B2	Must be rust resistant
SU14	B2	Can withstand temperatures and weather conditions
SU14	B2	Easy to clean if needed
SU14	B2	Lets user know when locked
SU14	B2	Won't pinch fingers or legs while riding
SU14	B2	Simple lock mechanism
SU14	B2	Young kids should be able to use
SU14	B2	Fits different size bikes
SU14	B2	Does not damage bike
SU14	B2	Easy to use (straightforward)
SU11B	B2	Able to lock the bicycle to an object to prevent theft

SU11B	B2	Located in a spot that doesn't intrude on operation
SU11B	B2	Long lasting - durable
SU11B	B2	Adjustable
SU11B	B2	Removable
SU11B	B2	Universal fit on most/all bikes
SU11B	B2	Small enough to not be in the way
SU11B	B2	Weigh less than 2 lbs
SU11B	B2	Cost less than $25
SU11B	B2	Strong enough to withstand cutting/breaking
SU11B	B2	Easily used - easy to lock/remove for riding
SU11B	B2	Must fasten tight to bike
SU11B	B2	Withstand impact if bike is crashed
SU11B	B2	Weather resistant
SU11B	B2	Must have adjustable locking method to different objects
SU11B	B2	Convenient locking/unlocking method for user
SU11B	B2	Small enough to remove and store if necessary
TE27	B2	Must be strong enough to lock the bike
TE27	B2	Must not interfere with normal bike use
TE27	B2	Must weigh less than 5 pounds
TE27	B2	Must cost less than $20
TE27	B2	Must be removable
TE27	B2	Must be adjustable
TE27	B2	Must not be activatable while riding
TE27	B2	Must have a key to unlock
TE27	B2	Must be able to be mass produced
TE27	B2	Must be cleanable
TE27	B2	Must display whether it's in locked configuration
TE27	B2	Must not be cuttable with basic hand tools
TE27	B2	Must be activated with less than 5 lbs of force
TE27	B2	Must meet ANSI safety standards
TE27	B2	Must be weatherproof
TE27	B2	Must be small enough to fit in a backpack
JA04b	B2	Under $20
JA04b	B2	Weather resistant - won't rust
JA04b	B2	Sturdy (can't be broken open)
JA04b	B2	Key hole /key won't strip
JA04b	B2	Under a pound-ish
JA04b	B2	Attaches comfortably to bike
JA04b	B2	Lock holds until unlocked
JA04b	B2	Safe/ergonomic - no sharp/harmful edges
JA04b	B2	Small volume - portable
JA04b	B2	Quiet - doesn't make obnoxious rattling noise when attached and riding
JA04b	B2	Long-lasting
JA04b	B2	Permanently in place
JA04b	B2	Not ugly - somewhat usually appealing
VI10	B2	Must not come in contact with cyclist while riding
VI10	B2	Must be made of non-rusting materials
VI10	B2	Permanently fastened to bike
VI10	B2	Must cost less than 5% of value of bike
VI10	B2	Must weigh less than 10% of bike weight
VI10	B2	Must not be able to interfere with moving parts while riding
VI10	B2	Must not have sharp edges
VI10	B2	Must be able to attach to different types of bikes
VI10	B2	Must resist cutting from basic tools
VI10	B2	Must take less than 30 seconds to fasten/engage
VI10	B2	Must take ~30 seconds max to unfasten
MI09	B2	It must be able to lock
MI09	B2	It must be permanently mounted
MI09	B2	It must be adjustable if necessary
MI09	B2	It must be small enough not to bother the rider
MI09	B2	It must be lightweight
MI09	B2	Should be inexpensive
MI09	B2	Should be easy to use
MI09	B2	Should take a short amount of time to lock and unlock
MI09	B2	It should match the bike colors
MI09	B2	It should be made to be added on existing bikes
MI09	B2	It should not rust
MI09	B2	It should be long enough to reach bike racks
MI09	B2	It should not be able to be cut or broken
AN24	B2	Lightweight
AN24	B2	Safe distance from pedals and chain
AN24	B2	Easily adjustable by hand
AN24	B2	Low cost
AN24	B2	Strong enough to not be easily removed by non-owner
AN24	B2	Not near tire
AN24	B2	Stays connected to bike
AN24	B2	Isn't long

AN24	B2	Extendable
AN24	B2	Withstand force
AN24	B2	Withstand multiple climates/temperatures
AN24	B2	Rust resistant
AN24	B2	Easy to use for multiple age groups
AN24	B2	Easy to lock and unlock
AN24	B2	Easy to clean without harming user
AN24	B2	Able to fit on different sized bikes
AN24	B2	Must be able to attach to different sized stationary objects
AN24	B2	Must be long lasting
DI15	B2	Durable
DI15	B2	Quick to manufacture (1 hour total)
DI15	B2	Recyclable
DI15	B2	No sharp edges
DI15	B2	Can fit on all bikes
DI15	B2	Must work on front or back wheel
DI15	B2	Less than 5 lbs
DI15	B2	Less than $10 to manufacture
DI15	B2	Rust resistant
DI15	B2	Must be removed with special tooling
DI15	B2	No pinch points
DI15	B2	Must use code rather than key
DI15	B2	Can be unlocked with phone
DI15	B2	Use little power
DI15	B2	Battery lasts 3 years
MA22	B2	Must be less than 10 lbs
MA22	B2	Must attach to the bike
MA22	B2	Must require a certain level of force to remove (so as to not be removed)
MA22	B2	Must be unobtrusive while the bike is in use
MA22	B2	Must cost less than $40
MA22	B2	Must be made of lightweight, recycled material
MA22	B2	No pinch points
MA22	B2	Must be rust resistant
MA22	B2	Must not rattle or make noise while the bike is in use
MA22	B2	No sharp edges
MA22	B2	Must be compact enough to stow on the bike
MA22	B2	Must be usable by a single user
MA22	B2	Must be a combination lock
GI17	B2	Should weigh less than equal to 1 lb
GI17	B2	Must be made of a sturdy metal
GI17	B2	Can't be broken under forces of 50 lb or more
GI17	B2	Must not hit against the bicycle while in motion
GI17	B2	Can be used by young kids (5-6 years old)
GI17	B2	No pointed or sharp edges around the lock
GI17	B2	Cost less than $50 to make and produce
GI17	B2	Must withstand weather (heavy rain, heavy snow, strong winds)
AM05	B2	Small enough to fit under seat
AM05	B2	Lightweight but strong- coated steel cable
AM05	B2	Less than 2 lbs
AM05	B2	Less than $20 to manufacture
AM05	B2	Made of weather resistant material
AM05	B2	Bicyclists are able bodied so only "easy to use" with 2 hands
AM05	B2	Must not break under load
AM05	B2	No pinch points
AM05	B2	No extensive machining to manufacture
AM05	B2	Must be able to verify when locked
LI04	B2	Doesn't impede normal operation of bike
LI04	B2	<1 pound
LI04	B2	<$5 to produce
LI04	B2	Made of a corrosion resistant material
LI04	B2	Can be removed when not in use
LI04	B2	Can be mounted in multiple places
LI04	B2	A 10 year old must be able to operate it
LI04	B2	Shouldn't require any maintenance
LI04	B2	No sharp edges
RE08	B2	Must last 5 years
RE08	B2	Must be removable
RE08	B2	Must be less than 2 lbs
RE08	B2	Must not allow removal of bike from lock without key
RE08	B2	Must fit a standard bicycle
RE08	B2	Must cost less than $20
RE08	B2	Must fit into a bike basket when not attached
RE08	B2	Must prevent theft of the bike
GE08	B2	Lock should be lightweight
GE08	B2	Lock should be small (not obtrusive to cyclist while riding)
GE08	B2	Lock should be permanently fastened to bike
GE08	B2	Lock should be able to last for a long time (lifespan of bicycle)

GE08	B2	Lock should be relatively inexpensive (<$30)
GE08	B2	Lock should withstand harsh weather conditions (not rust)
GE08	B2	Lock should be strong; able to withstand boltcutters
GE08	B2	Lock chain should be long enough to put around a tree/lightpost
GE08	B2	Lock should be secure; key lock
GE08	B2	Lock should withstand impact of bike falling over/ hitting a tree
GE08	B2	Lock should be removable/adjustable if correct combination/key is in it
MA15	B2	Constraint: Lock mechanism attached to bike
MA15	B2	Lock must be durable but removable
MA15	B2	Constraint: Must not interfere with operator
MA15	B2	Geometry: small
MA15	B2	Forces: protect bike from theft
MA15	B2	Forces: human generated forces
MA15	B2	Energy: must not add excessive weight to bike (energy expended) (2.5% of the weight)(10)
MA15	B2	Material: non corrosive (puddles, rain, weather)
MA15	B2	Material: strong to prevent damage from falls/theft
MA15	B2	Signal: allow user to know when stored
MA15	B2	Signal: allow user to know when locked
MA15	B2	Production: Must not add cost to other manufacturing i.e. alter frame
MA15	B2	Operation: Someone of age (10) must be able to use
MA15	B2	Maintenance: removable/replaceable locking mechanism
CH05	B2	Must not be able to withstand 5000lbf
CH05	B2	Must be corrosive resistant
CH05	B2	Must last 5 years
CH05	B2	Must weigh under 2lbs
CH05	B2	Must be able to be removed or adjusted
CH05	B2	Must be safe for user
CH05	B2	Must be usable by 5 year old
CH05	B2	Must cost under $25
CH05	B2	Must be able to fit all bikes
CH05	B2	Must be metal
CH05	B2	Must have a key slot, or a code
CH05	B2	Must fit in bike free space
CH05	B2	Must be able to lock to variety of objects
CH05	B2	Must not damage bike
CH05	B2	Must not affect rider
CH05	B2	Must not fall off, not easily removed
CH05	B2	Must prevent theft
VI20	B2	Must secure bike when locked down
VI20	B2	Must be able to function bike with lock still attached
VI20	B2	Must be operable by one person
VI20	B2	Must be reasonably priced
VI20	B2	Light weight and portable
VI20	B2	Must be able to be removed if desired by owner (not permanently affixed anymore)
VI20	B2	Must meet regulated lock safety standards
VI20	B2	Must be able to use on wide range of bicycle types
VI20	B2	Lock must be durable and longlasting
CH06	B2	Total cost to manufacture product must be less than $10
CH06	B2	Design cannot last longer than 6 months
CH06	B2	Product must weigh less than 2.5 lbs
CH06	B2	Can be removed if necessary
CH06	B2	Can stay attached when bike is in motion
CH06	B2	A ten year-old must be able to operate it
CH06	B2	Safe to use and limits chances of pinched skin
CH06	B2	Takes no more than 5 lbs force to open and close lock
CH06	B2	At least 1000 unique lock combinations or at least 1000 model of keys
CH06	B2	Product must survive 10 years of use and environmental stress
CH06	B2	An audible mechanical or electronic sound must be made when it locks
CH06	B2	Made of a material that can withstand a 200 lb impact force without failure
CH06	B2	Must be able to operate with one hand
CH06	B2	Can be attached to the bike under 5 minutes
CH06	B2	Lock and unlock procedure must take no longer than 15 seconds each
CH06	B2	Must fit in a 4"x4"x4" box
MA10	B2	Must cost less than $10
MA10	B2	Materials must be approved by applicable codes
MA10	B2	Must weigh less than 5 lb
MA10	B2	Must not protrude more than 5" from frame
MA10	B2	Must stay locked with up to 200 lb of pulling force
MA10	B2	Must have easy access to clean
MA10	B2	Must have dial that allows for locking/unlocking
MA10	B2	Must have a way to remove without destroying
MA10	B2	Material can be cut by standard bolt cutters for removal if code is forgotten
MA10	B2	No sharp edges that could cause cutting
MA10	B2	Lock does not clamp shut in less than 1 sec to allow fingers to be removed if in way of closing
MA10	B2	Dial must fit in the average human hand (more research needed for size)
MA10	B2	Must be less than 5 parts for easy assembly
MA10	B2	Must be aesthetically pleasing

JU22	B2	Must fasten to the bicycle
JU22	B2	Must not obtrude the bicyclist
JU22	B2	Must be repositional on bike
JU22	B2	Must weigh less than 1 lb
JU22	B2	Must cost less than $30
JU22	B2	Must have security fasteners to prevent unwanted disconnection of lock
JU22	B2	Must be cut proof using hand tools
JU22	B2	Must be contained within width of bike frame
JU22	B2	Must be corrosion proof
JU22	B2	Must be able to be locked/unlocked in the same time or quicker than those on market
JU22	B2	Must fold away when not in use
JU22	B2	Must be impact/scratch resistant
JU22	B2	No pinch points or sharp edges
JU22	B2	Cannot damage or alter bike
JU22	B2	Installed in under 5 minutes
JU22	B2	Require no expertise/special knowledge to install
JU22	B2	Include tamper-proof tools to install
JU22	B2	Must fit 95+% of standard bikes
JU22	B2	Must fit 95% or more of standard bike racks
JU22	B2	Campatible with racing, mountain, road, and BMX bikes
JU22	B2	Ideally located near bikes center of mass
JU22	B2	Must clearly signal to user that lock is indeed locked
ME12	B2	Lock must be permanently fastened to the bike
ME12	B2	Lock must be able to remove or adjusted if necessary
ME12	B2	Lock must be durable enough to be a lasting accessory
ME12	B2	Lock must not interfere with the performance of the bike when being operated
ME12	B2	Lock must be light weight
ME12	B2	Lock must be relatively inexpensive
ME12	B2	Lock must successfully function as a safety lock when activated
CH09	B2	The safety lock must be able to attach permanently to a bicycle
CH09	B2	The safety lock must not hinder the use of the bicycle while consumer is riding
CH09	B2	The safety lock must withstand at least 5 years of use
CH09	B2	The safety lock must be able to be removed
CH09	B2	The safety lock must be able to be adjusted with minimum motion
CH09	B2	The safety lock must be able to be used with minimum motion
CH09	B2	The safety lock must be made out of material that can withstand water
CH09	B2	The safety lock must be able to withstand the impact of a 200 lb force
CH09	B2	The safety lock must make a sound when lock fastened
CH09	B2	The safety lock should be as small as possible
CH09	B2	The safety lock should be as light weight as possible
CH09	B2	The safety lock should cost the smallest amount possible
CH09	B2	The material the safety lock is made of should not reflect light enough to distract the hinder
CH09	B2	The safety lock should require minimum routine maintenance
CH09	B2	The safety lock should be able to be used by a 6 year old
KI12	B2	Should fit in 6in^3 volume
KI12	B2	Must be able to be fastened to part of bike not in line of motion of user
KI12	B2	Must not block bike from being able to roll
KI12	B2	Must not touch the ground while bike is in motion
KI12	B2	Must not increase force needed to operate bike
KI12	B2	Must be made with material that does not corrode
KI12	B2	Must be able to put on bike with one hand
KI12	B2	Must not require external power source
KI12	B2	Must not have pinch points
KI12	B2	Must cost less than $15
KI12	B2	Must weigh less than 1 pound
KI12	B2	Must be able to reattach to a bike after being removed
KI12	B2	Must be designed within one month
KI12	B2	Must be able to produce 500/day
KI12	B2	Must not require more than 2 pounds of force to clamp to bike
KI12	B2	Aesthetically pleasing
KI12	B2	No sharp edges
KI12	B2	Prototyping must not exceed $100
KI12	B2	Material cannot be cut with bolt cutters (prevent theft)
DE15	B2	Cost as little as possible
DE15	B2	Kept small
DE15	B2	Adjustable
DE15	B2	Fixed feature
DE15	B2	Lightweight
DE15	B2	Durable
DE15	B2	Made out of a material that doesn't get hot easily so doesn't burn person
DE15	B2	Easy to add/remove from bike in case of repair/replacement
DE15	B2	Easy to use
DE15	B2	No sharp edges
DE15	B2	Easily produced
DE15	B2	Easy to transport after sell on bike
DE15	B2	Packaging that makes it easy to transport before sell
DE15	B2	Easily maintained

DE15	B2	Recycled materials
DE15	B2	Aesthetically pleasing
DE15	B2	Placed in an easily accessible area, but also where it blends into bike to not draw unwanted attention
DE15	B2	Must actually prevent theft of bike
LI04b	B2	Must be able to lock bicycle
LI04b	B2	Lock to be permanently fastened to bike
LI04b	B2	Must be durable to a lasting accessory
LI04b	B2	Must not obtrude from bike
LI04b	B2	Must not interfere with cyclist
LI04b	B2	Must be <1.5 lb
LI04b	B2	Must be <$10
LI04b	B2	Must not rust
LI04b	B2	Must have a programmable lock code
LI04b	B2	Must withstand rain
LI04b	B2	Must be easy to use
LI04b	B2	Must allow for locking in <10sec
LI04b	B2	Must be able to be mass produced
LI04b	B2	Must not be easily hacked
LI04b	B2	Must be difficult to cut
LI04b	B2	Must not need any maintenance in lifespan
LI04b	B2	Must last at least 10 years
LI04b	B2	Must be made of recyclable material
LI04b	B2	Must be adjustable for many bike types
LI04b	B2	Must require low exertion from user to lock and unlock
LI04b	B2	Must not need batteries or to be charged
LI04b	B2	Must fit in a 6"x2" box
LI04b	B2	Must be aesthetically pleasing
LI04b	B2	Lock code must be adjustable (if code)
LI04b	B2	Must prevent theft of bike
JO24	B2	Less than $X to make
JO24	B2	Can be installed by a child
JO24	B2	Small and lightweight
JO24	B2	Strong enough material to withstand x amount of force
JO24	B2	Does not harm user when activated under certain conditions
JO24	B2	Can be re-installed x number of times
JO24	B2	Replace after x number of uses
JO24	B2	Can be used on any bike
AN18	B2	Cost less than $15
AN18	B2	Cost less than $10
AN18	B2	Cost less than $5
AN18	B2	Weigh less than 10 lbs
AN18	B2	Weigh less than 8 lbs
AN18	B2	Weigh less than 5 lbs
AN18	B2	Weigh less than 2 lbs
AN18	B2	Be smaller than 15 in x 15 in footprint
AN18	B2	Be smaller than 10 in x 10 in footprint
AN18	B2	Be smaller than 5 in x 5 in footprint
AN18	B2	Be smaller than 2 in x 2 in footprint
AN18	B2	Increase drag on bike by less than 10%
AN18	B2	Be made of material that will not rust
AN18	B2	Able to withstand impact from another bike at 10 mph
AN18	B2	Able to withstand kick from biker
AN18	B2	Able to install in less than 5 minutes
AN18	B2	Able install in less than 1 minute
AN18	B2	Able to install in less than 30 seconds
AN18	B2	Able to be recycled at any metal recycle plant
AN18	B2	Able to be recycled plastic
AN18	B2	Made of metal
AN18	B2	Made of plastic
AN18	B2	Able to be removed in less than 10 minutes
AN18	B2	Able to be removed in less than 5 minutes
AN18	B2	Able to be removed in less than 1 minute
AN18	B2	Must not impede rotation of pedals
AN18	B2	Must be able to be produced with less than 1 defect out of every million
AN18	B2	Must be able to be manufactured with less than 100 defects out of every million
AN18	B2	Must be able to last in field for over 1 year
AN18	B2	Must be able to last in field for over 5 years
AN18	B2	Must be able to last in field for over 10 years
AN18	B2	Must not have to be cleaned ever
AN18	B2	Must be able to be maintained with parts from ACE Hardware
ME25	B2	Lightweight material
ME25	B2	Strong material
ME25	B2	Geometrically simple
ME25	B2	Enclosed locking mechanism
ME25	B2	Non-corrosive material
ME25	B2	Designed to mount un-obtrusively
ME25	B2	Simple installation/removal process requiring specialized tool

ME25	B2	Locking material should be very strong
ME25	B2	Easily manufactured in mass
ME25	B2	Signals the user when successfully locked
ME25	B2	Customizable colors to be inconspicuous
ME25	B2	No user assembly
ME25	B2	Strong key material
ME25	B2	Option to locate key digitally
VI01	B2	Weigh less than 1 lb
VI01	B2	Cost less than $20 to produce
VI01	B2	Fit within a 6"x6"x6" box
VI01	B2	Not have any pinch points for use
VI01	B2	Be operable with 1 hand
VI01	B2	Be completely mechanical (no electrical components)
VI01	B2	Be safe
VI01	B2	Be made of a material that is strong and non corrosive
VI01	B2	Have an indicator that lock is properly secured
VI01	B2	Fit on the frame of most bikes
VI01	B2	Lock onto different types of posts
VI01	B2	Require only an alan wrench for intallation
VI01	B2	Be able to be made in few steps
VI01	B2	Lock both the front wheel and frame (be secure)
VI01	B2	Be unlocked with 1 hand and no extra accessories (i.e combo lock, no key)
VI01	B2	Not make loud rattling when not in use (quiet)
VI01	B2	No specialized materials that are hard to be disposed of after use
VI01	B2	Completely contained when not in use
MA12	B2	Safety- no sharp edges, won't fall off
MA12	B2	Permanently fashioned to bike if desired
MA12	B2	Small enough, probably 6 in or smaller
MA12	B2	Light weight weigh no more than 1/2 lb
MA12	B2	Inexpensive-cost $15 or less
MA12	B2	Mechanisms are easy to access for repair
MA12	B2	Aerodynamic-curved surface
MA12	B2	Withstand wind speed up to 20mi/hr
MA12	B2	Light indicator to show when in use
MA12	B2	Rechargeable or battery powered
MA12	B2	Easy to take apart and clean if necessary
MA12	B2	Does not consume power when not in use
MA12	B2	Production ease, parts are of simple geometry
MA12	B2	Easy to understand intructions of assembly
MA12	B2	Another light to indicate malfunction
MA12	B2	Another light to indicated attachment to bike
MA12	B2	Small packaging
MA12	B2	Can be carried in one hand
KA02b	B2	Require special tool to remove
KA02b	B2	Less than $100
KA02b	B2	Less than 3 lb
KA02b	B2	Not interfere with rider (dependent on bike geometry)
KA02b	B2	Corrosion resistant (specified by customer)
KA02b	B2	Secure bike to stand/trees (function same as external loads)
KA02b	B2	Assembly cost lower than target (specify)
KA02b	B2	Simple instructions/use (1pg/10 slide manual)
KA02b	B2	Multiple locating points on bike >3
KA02b	B2	Profitable to company
KA02b	B2	No burs
KA02b	B2	No radis active material (50 state legal)
SA04b	B2	It must have a permanent fastener
SA04b	B2	It must have the ability to be removed
SA04b	B2	It must have the ability to be adjusted
SA04b	B2	It must have a cost similar to a removable bike lock
SA04b	B2	It must not interfere with wheel motion
SA04b	B2	It should be less than 8 lbs
SA04b	B2	It should be rounded/not sharp
SA04b	B2	It should lock the main frame to the post
SA04b	B2	It should match the bike aesthetic
SA04b	B2	It should be an optional feature
SA04b	B2	It should be made of similar material as bike
SA04b	B2	It should be amanual
SA04b	B2	It should not be able to become locked while bike is in use (safety)
SA04b	B2	It should require little force to lock
SA04b	B2	It should be weather resistant
JA04	B2	Shall be circular in cross-section
JA04	B2	Shall have no thicker than diameter of bike frame tube
JA04	B2	Shall have circumference of 2 feet
JA04	B2	Shall be mounted to bike frame via brackets
JA04	B2	Shall be mounted underneath main frame and tube
JA04	B2	Shall be mounted between pedals
JA04	B2	Shall be mounted above gear train

JA04	B2	Shall be opened with 4-digit numeric passcode
JA04	B2	Shall be rain-resistant
JA04	B2	Shall be less than 2 pounds
JA04	B2	Shall not move when not in use
JA04	B2	Shall be secured when not in use via stral
JA04	B2	Shall have arrow pointing to passcode alignent
JA04	B2	Shall be resistant to bolt-cutters
JA04	B2	Shall lock by twisting pulling mechanism
JA04	B2	Shall be sold less than $20 per unit
JA04	B2	Shall have life of 5 years
JA04	B2	Shall be manufactured for less than $12 per unit
JA04	B2	Shall have development costs less than $1000 total
AN09	A2	Must clear the bookshelves to avoid damaging books
AN09	A2	Platform must be rigid (No noticable shaking when study on it)
AN09	A2	Weight capacity of at least 350 lb
AN09	A2	Hanrails on both sides
AN09	A2	Rail around entire platform if it rises over 4 ft off the ground
AN09	A2	Eye for safety harnesses tether for when it goes over 4 ft up
AN09	A2	Retractable custom tape to warn people of the danger when in use
AN09	A2	Max rise and lower velocity of 0.5 ft/s
AN09	A2	Easy access swing gate
AN09	A2	Footstep painted yellow
GI21	A2	Must be able to hold all sized wheelchairs
GI21	A2	Must be able to hold at least 600 pounds
GI21	A2	Must have anchoring so that shelf does not tip
GI21	A2	Must not interfere with bookcase/books
GI21	A2	Must not "jerk" during operation
GI21	A2	Must be easy to operate
GI21	A2	Must have small operating envelope
GI21	A2	Must be able to fit in between shelves
GI21	A2	Must operate to a height of at least 10 ft
GI21	A2	Can be installed by 1 technician
GI21	A2	Silent operation
GI21	A2	Safety measures to prevent falling
GI21	A2	No sharp edges
GI21	A2	Limited maintenance design
GI21	A2	Must not cost a lot to develop, unit price not a bug deal
GI21	A2	Must not fail (overdesign)
GI21	A2	Must have sensors to prohibit use if not safe
GI21	A2	Swivel apparatus to easily reach books
GI21	A2	Cannot get too hot
GI21	A2	Must be hydraulic or electric
CH15	A2	Narrow enough to not get in the way of books
CH15	A2	Tall enough to reach all levels of books
CH15	A2	Be able to bring book down to wheelchair level
CH15	A2	Smooth operation
CH15	A2	Easy to assemble
CH15	A2	Easy to use
CH15	A2	Quiet as a whisper
CH15	A2	Be able to hold at least 30 lbs to accommodate for large books
CH15	A2	Grippers must be able to pick up large and small books
CH15	A2	Be able to pick up books of different height
CH15	A2	Run on electricity
CH15	A2	Have a fail safe just in case the power goes out so that it doesn't drop a book
CH15	A2	Cheap material
CH15	A2	No sharp edges
CH15	A2	Not be able to come down on someone
CH15	A2	Can't smash fingers
CH15	A2	Buttons at wheel chair height
CH15	A2	Cheap to make
CH15	A2	Can be installed on different dimension bookshelves
CH15	A2	Come in small package so many can be shipped at once
CH15	A2	Few moving parts
CH15	A2	Soft ends so it doesn't damage books
CH15	A2	Off the shelf parts
CH15	A2	Recyclable materials
CH15	A2	Quick design
CH15	A2	Easy and cheap production
SU02	A2	Must not damage items
SU02	A2	Must be usable for anyone older than a toddler
SU02	A2	Should be easily stored
SU02	A2	Should be strong enough to lift everyday items
SU02	A2	Cast as little as possible
SU02	A2	User operation is simple/basic
SU02	A2	Easy to manufacture
SU02	A2	Made of recyclable materials
SU02	A2	If electric, should be energy efficient

SU02	A2	Must be capable of transportation
SU02	A2	Capable of assembly on existing bookshelves
SU02	A2	Expand/contractable for various sized shelves
SU02	A2	Reach items within bookshelf area (range of motion)
LO01	A2	Must be safe for disabled people to use
LO01	A2	Must be safe for children to use
LO01	A2	Must allow to person to grab a specific book they want
LO01	A2	Must not apply enough force to damage book, or too little so that the book falls
LO01	A2	Must require less than 10 lbf to operate
LO01	A2	Should be able to use with one hand
LO01	A2	Should be at least 4 ft in length
LO01	A2	Must not break easily (after a few uses)
LO01	A2	Should be durable
LO01	A2	Should be lightweight (less than 10 lbs)
LO01	A2	Should be inexpensive (less than $100)
LO01	A2	Design should allow for adaptive attachments for various shelves
LO01	A2	Should be able to grab various size books
LO01	A2	Should be able to grab various weights
LO01	A2	Must be simple to use, with little to no instructions required
LO01	A2	Should look appealing
LO01	A2	Should have an ergonomic grip for users
LO01	A2	Should be easy to assemble
LO01	A2	Should be made of a few parts
JU02	A2	Be able to grab books of varing sizes
JU02	A2	Stretch at least 6 ft up
JU02	A2	Puts no additional damage or stress on books
JU02	A2	Simple enough to install and use so an untrained librarian can use it
JU02	A2	Easy to reach system from ground
JU02	A2	Books should not have the ability to fall
JU02	A2	Safe to use, if user has zero chance of any injury if used properly
JU02	A2	Extendable to reach different levels
JU02	A2	Can support up to 50 lbs
JU02	A2	Little to no maintenance
JU02	A2	Little to no sound produced while in use
JU02	A2	Be able to accurately put books back
JU02	A2	Easy enough to use so book can be retrieved in 30 secs
JU02	A2	Operate smoothly. Jerk of system does not exceed set limit
LO03	A2	Device must be able to reach a height of 6 ft minimum
LO03	A2	Device must not damage book
LO03	A2	Device must require little skill to use (for all ages)
LO03	A2	Device should be entirely mechanical (no electricity)
LO03	A2	Device should be safe for all ages
LO03	A2	Device should require little to no maintenance
LO03	A2	Device should be easy to install
LO03	A2	Device should be sturdy so it does not break easily
LO03	A2	Device should be inexpensive (<$40)
LO03	A2	Device should be able to be installed on most existing bookshelves
LO03	A2	Device should be able to grab all sizes of books
AM20	A2	No chance of the mechanism falling on the user
AM20	A2	The mechanism should be small enough to not be in the way of the walkway
AM20	A2	No sharp parts to hurt anyone/damage books
AM20	A2	No cracks to pull at pages of the book
AM20	A2	Relatively simple, local librarian could set it up with no problems
AM20	A2	Make it universal so that it could fit on most bookshelves
AM20	A2	Can do no damage to a wheelchair
MA19	A2	Simple design
MA19	A2	Can attach to bookshelves
MA19	A2	Able to reach 6 ft
MA19	A2	Require little force to operate with hand
MA19	A2	Comfortable grip
MA19	A2	Soft enough not to damage books
MA19	A2	Safe
MA19	A2	No pinching hazards
MA19	A2	No sharp edges
MA19	A2	Accessible for children in wheelchair
MA19	A2	Grip good enough not to let the book slip
MA19	A2	Follow all ADA requirements
MA19	A2	Lightweight
MA19	A2	Aesthetically pleasing
MA19	A2	Easily installed
MA19	A2	Easily adjusted
MA19	A2	Able to be manufactured
MA19	A2	Good for 10000 + uses
MA19	A2	Durable
MA19	A2	Able to withstand a bump from a wheelchair
MA19	A2	Inexpensive
MA19	A2	Joints bend smoothly

MA19	A2	Instructions for maintenance must be clear and simple
MA19	A2	Come with spare parts
MA19	A2	Easily be stored
MA19	A2	Recyclable parts
SA11	A2	Safe to use
SA11	A2	Convenient
SA11	A2	Small enough to not take up too much room
SA11	A2	No sharp edge
SA11	A2	Easy to assemble
SA11	A2	Grab books from 6 ft and above
SA11	A2	Simple enough to fit on most bookshelves
SA11	A2	Strong enough to hold books
SA11	A2	Easy to manufacture
SA11	A2	Smallest cost as possible
SA11	A2	Easy to transport
SA11	A2	Easy for movement around house
SA11	A2	No damage to books
SA11	A2	Aesthetically appeasing
SA11	A2	Easy to clean and take care of
SA11	A2	Come with spare parts
SA11	A2	Easy assembly for people in wheelchairs
SA11	A2	Relatively light
SA11	A2	Material choice as light and durable as possible
SA11	A2	Easy to operate
SA11	A2	Ability to be recycled after it is not longer in use
JE06	A2	Safe to use
JE06	A2	No sharp edges
JE06	A2	No pinch points
JE06	A2	Usable by people in wheelchairs
JE06	A2	Grabs books
JE06	A2	Does not damage books
JE06	A2	Does not drop books
JE06	A2	Can reach at least 8 ft
JE06	A2	Must be easy to operate
JE06	A2	People over age 8 can use
JE06	A2	Doesn't have rough motion
JE06	A2	Lightweight (<10lbs) if handheld
JE06	A2	Not many components (simple)
JE06	A2	Simple fixture for installation
JE06	A2	Easy to install
JE06	A2	Must be easily accessible for people in wheelchairs
JE06	A2	Functionality must be obvious
JE06	A2	Must not damage bookshelf
JE06	A2	Must be removable
JE06	A2	Must operate quietly
JE06	A2	Must be able to hold ~20 lbs of books/load
JE10	A2	Must not in any way harm the user
JE10	A2	Must be light enough to carry (<7lbs)
JE10	A2	Must be at least 6 ft long
JE10	A2	Must be able to pick up at least 2 books
JE10	A2	Must be able to hold 7 lbs without breaking
JE10	A2	Must not leave any visible damage on the book
JE10	A2	Must be able to be used by a 5 year old (simple)
JE10	A2	Must retract so that a handicapped person doesn't have to weild a 6" rod
JE10	A2	Must be able to be used by one person solo
JE10	A2	Must be able to be installed on any common bookshelf
JE10	A2	Must not cause lasting damage to the bookshelf
JE10	A2	Must be easily removed from the bookshelf
JE10	A2	Must be able to be used with only one hand
JE10	A2	Must be able to be used without lifting your arm off of the wheelchairs arm rest
JE10	A2	Must not interfere with the wheelchair
JE10	A2	Must not rust or decay after 5 years
JE10	A2	Must be <$40
JE10	A2	Take less than 1 minute to get 3 books
JE10	A2	Must run smoothly (one continuous motion)
JE10	A2	Must not require the user to lean forwards/backwards/sideways out of their wheelchair
JE10	A2	Must be easy for the wheelchair to wheel up to
JE10	A2	Must be easy to clean around
JE10	A2	Must be used by a non-handicapped user just as easily
TA06	A2	Safe to use
TA06	A2	Convenient
TA06	A2	Non-damaging
TA06	A2	Must be shock proof
TA06	A2	Must be light
TA06	A2	Must signal when battery is low
TA06	A2	Must be usable from ground and up high
TA06	A2	Must not corrode

TA06	A2	Must be quiet
TA06	A2	Must be able to move slowly
TA06	A2	Must have a light to see in dark areas
TA06	A2	Must be affordable
TA06	A2	Must be compactable
TA06	A2	Must work for people of all size under 400 lbs (size)
TA06	A2	Must have spare parts readily available at store
TA06	A2	Needs a signal to let user know that the book is in secure
TA06	A2	Needs a safe battery for 9 hours of use
TA06	A2	Must handle book weights up to 10 kg
TA06	A2	Must handle people 400lb and below (weight)
TA06	A2	Must balance well
TA06	A2	Must be secure
TA06	A2	Must be easy to produce
TA06	A2	Waterproof
BR02	A2	Device should weigh no more than 5 lbs
BR02	A2	Device must not have sharp edges
BR02	A2	Device should be able to reach a height of at least 6 ft
BR02	A2	Device should not have more than 6 moving parts
BR02	A2	Device should be able to firmly grip books up to 25 lbs
AN11	A2	Must work with most bookshelves
AN11	A2	Safe
AN11	A2	Convenient
AN11	A2	Operate smoothly
AN11	A2	Must not require too much force from operator
AN11	A2	Silent operation
AN11	A2	Affordable for public libraries
AN11	A2	Work within space between 2 bookshelves
AN11	A2	Not too heavy that it collapse shelf
AN11	A2	Fit seamlessly into shelf (not bulky)
KA05	A2	Safe
KA05	A2	Simple
KA05	A2	Can reach top shelf (6ft)
KA05	A2	Easily operated by elderly
KA05	A2	Light to no lifting
KA05	A2	Fit on a large range of bookshelves
KA05	A2	Easy to install on bookshelf
KA05	A2	Doesn't take a lot of time to operate
KA05	A2	Can be stored on/in bookshelf
CI26	A2	6 ft or higher
CI26	A2	Safe
CI26	A2	No sharp objects
CI26	A2	Moves slowly
CI26	A2	Convenient
CI26	A2	Does not require a lot of force
CI26	A2	Easy learning curve to use it
CI26	A2	Operate smoothly
CI26	A2	Light weight
CI26	A2	Easy to grip (if hand held)
CI26	A2	Strong enough to support weight of books
CI26	A2	Installed onto bookshelf
CI26	A2	Doesn't damage shelf
CI26	A2	Doesn't damage books
CI26	A2	Simple, so not many parts
CI26	A2	Powered by outlet (plug-in)
CI26	A2	Easy to transport
LY04	A2	Needs to be safe for all users
LY04	A2	Must be easy to use for anybody over age of 5
LY04	A2	Material must not fail under weight of books
LY04	A2	Mechanism must reach at least 6 ft
LY04	A2	Mechanism must be easily transported with only a wheelchair
LY04	A2	Must operate without any bumps so books don't fall
LY04	A2	Must be able to be mass produced
LY04	A2	Must be able to not break on impact
LY04	A2	Must not require so much energy that the person struggles
LY04	A2	Must be <$40
LY04	A2	Must be easy to fix and have general parts
LY04	A2	Must be applicable to any size book
LY04	A2	Must work
LY04	A2	Must be easily accessible for those in wheelchairs
LY04	A2	Must meet a deadline given by customer
LY04	A2	Must be applicable to any standard bookshelf
JE17	A2	Must be made of lightweight plastic material
JE17	A2	Must be able to withstand 5 lbs of force
JE17	A2	Must have the ability to select certain books
JE17	A2	Must be able to be operated by handicapped people
JE17	A2	Must have a safety mechanism so the book isn't dropped

JE17	A2	Must be able to be installed by someone in a wheelchair
JE17	A2	Must be able to be maintained by someone in a wheelchair
JE17	A2	Must cost less than $100
JE17	A2	The part that grips the book must be made of rubber
JE17	A2	The device must not corrode
JE17	A2	The device must weigh less than 20 lbs
JE17	A2	The device should not impede regular usage of the bookshelf
JE17	A2	The device shall cost no more than $50 to produce
JE17	A2	The device must operate off of a standard home outlet (120 V AC)
JE17	A2	Must display that if is in operation
JE17	A2	Able to be mass produced
SA06	A2	Create device to get books off of the bookshelf
SA06	A2	Built for 6 or higher
SA06	A2	Must be safe
SA06	A2	Can't harm books
SA06	A2	Must be usable from seated position
SA06	A2	Must be useable by someone strong enough to hold 5 lb
SA06	A2	Must allow wheelchair sizes to use
SA06	A2	Accommodate the possible user such as no legs or only 1 arm
SA06	A2	Must be quiet (in library)
SA06	A2	Must have clear user instructions for all ages
SA06	A2	Must be easy to install for librarian
SA06	A2	Little down time
SA06	A2	Easy to fix with common spare parts
SA06	A2	Cheap as there are many bookshelves (20$>)
SA06	A2	Must be able to return a book
SA06	A2	Low skill level to use, minimal coordination
SA06	A2	Must not interfere with other books or customers
MA02	A2	Must be able to retrieve books from left or higher
MA02	A2	Cannot damage books
MA02	A2	Must be able to be used by disabled person in wheel chair (ease of operation)
MA02	A2	Must be universal for all wheelchairs , general design
MA02	A2	Must be tall, but narrow as to not cause spatial issues
MA02	A2	Cannot impede use of wheelchair or bodily motion from user
MA02	A2	Must move slowly as to be able to be adjusted to specific height
MA02	A2	Must be sturdy enough to withstand weight of book
MA02	A2	Must be universal for installation on any bookshelf
MA02	A2	Must be easy to use , have a simple interface, so all ages can use it
MA02	A2	Must be simple design, and fairly inexpensive so it can be implemented on all bookshelves
MA02	A2	Few moving parts so as to avoid maintenance
MA02	A2	Designed to withstand wheelchair impacts
MA02	A2	Should be able to be disassembled and assembled with ease in case bookshelf is being moved/repositioned
MA02	A2	Should run on electricity from 120V outlet, allowing most libraries to use it
MA02	A2	Should not extend out too far from bookshelf, posing as an obstacle
MA02	A2	Should have sensors that prevent device from harming humans
MA02	A2	Should be able to retrieve book in less than a minute
CA11	A2	Size: Must fit on existing bookshelves
CA11	A2	Size and Safety: Must stow in a way that does not block library traffic
CA11	A2	Size: Must reach 6 ft vertically
CA11	A2	Stability: Must operate with smooth, slow, predictable motion
CA11	A2	Stabiliy: Must properly counterweighted or anchored
CA11	A2	Strength: Must be strong enough to lift books and survive moment created
CA11	A2	Simplicity: Easy to install by our workers on site
CA11	A2	Utility: Must not damage the books in the process
CA11	A2	Utility/simplicity: Must be intuitive to operate within minutes
CA11	A2	Utility/simplicity: Must minimize number of controls
MA01a	A2	Device must retrieve books from max height of 6 ft
MA01a	A2	Device must not endanger user (fall off bookshelf, drop/launch books at user/break bookshelf
MA01a	A2	Device must retrieve book without damaging book (soft paperbacks, delicate bindings)
MA01a	A2	Device must "convenient" translated to not create hesitation for user about whether or not to retrieve book because of cumbersome operation
MA01a	A2	Device must operate without disturbing ambience if reading environment (noisy servos, noisy actuators)
MA01a	A2	Device must simple enough for user to operate without being provided intructions/user manual
MA01a	A2	Device must fit all standard bookshelves
JO04	A2	Must be possible to install on existing bookshelves
JO04	A2	Must be durable to a lasting accessory
JO04	A2	Must be cost-efficient/affordable
JO04	A2	Must reach the highest bookshelf (6ft or higher)
JO04	A2	Must be easily operated with one hand
JO04	A2	Must be reachable from sitting position
JO04	A2	Must transport book to the user
JO04	A2	Must not damage bookshelf
JO04	A2	Must have simple mechanism design
JO04	A2	Easily maintained and fixed
JO04	A2	Installation should be few, simple steps
JO04	A2	Should complete task satisfactory to user
JO04	A2	Must be made of non-corrosive material
JO04	A2	No sharp edges

JO04	A2	Must be simple to operate and understand
JO04	A2	Book should have smooth transportation
JO04	A2	Controls of mechanism are smooth
JO04	A2	Must be able to transport all sizes of books
JO04	A2	Must not add much size to the bookshelf
JO04	A2	Made of recyclable materials
JO04	A2	Should not stich out into area in front of shelf (tripping hazard)
JO04	A2	Must be aesthetically pleasing
JO04	A2	Must be able to complete task of transporting book repetitively
JO04	A2	Should also transport book from bottom to top
LA07	A2	Must not devalue the books it picks up
LA07	A2	Must be installable on any geometry of bookshelf
LA07	A2	Must not use more than 20 kN of force
LA07	A2	Must be installable by a technician
LA07	A2	Must reach a minimum of 6 ft
LA07	A2	Must reach a maximum of 12 ft
LA07	A2	Must use less than 10Whr of energy per book
LA07	A2	Must be able to withstand collisions of 500 kN of force
LA07	A2	Must fit in a box 4ftx5ftx1ft
LA07	A2	Must not require maintenance more than once per year
LA07	A2	All moving parts must be covered
LA07	A2	Must be operatable using voice commands
LA07	A2	Must be turned on at all times
LA07	A2	Must show when mainenance is required
LA07	A2	Must retrieve books within 1 minute
LA07	A2	Must be made of metal exterior
LA07	A2	Must cost less than $20 to build
MI16	A2	Operatable with one hand
MI16	A2	Operating handle at wheelchair height
MI16	A2	No pinch points
MI16	A2	Require <5lbs force applied
MI16	A2	Operate smoothly with limited need for lubrication
MI16	A2	Pick up books without damaging them
MI16	A2	Reach a min height of 6 ft
MI16	A2	Must attach to current bookshelves
MI16	A2	Use minimum power if any
MI16	A2	Minimize cost
MI16	A2	Require very limited skill/motor function by user
MI16	A2	Withstand collisions from people and wheelchairs
MI16	A2	Take up minimum space on bookshelf
MI16	A2	Assemble each unit in < 20 min
MI16	A2	Moving in vertical and horizontal
MI16	A2	Move at low speeds to prevent hurtful impacts
MI16	A2	All moving parts have padded corners
MI16	A2	Lightweight material
CH02	A2	Device must be reachable from the average arm rest level of a wheelchair
CH02	A2	Only require one button to operate
CH02	A2	Fastened to the bookshelf so it can move side to side
CH02	A2	Mounting must withstand 50 lbs of pulling force
CH02	A2	Safety net or basket to catch loose books from falling on user
CH02	A2	Self balancing (like a cmm arm) so little force is required to operate it
CH02	A2	Should assemble with four components or less
CH02	A2	Cost between $150-$100 so libraries can afford it but quality is maintained
CH02	A2	Joints should be selfservicing so little maintenance is required (1 check up per year)
CH02	A2	Rubber pads on end that grabs books to reduce damage
CH02	A2	Indication light to tell user when book is properly secured
CH02	A2	Quiet
LI14	A2	Conduct all operations without risk of injury to users or spectators
LI14	A2	Conduct all operations without removing point or damaging a wooden bookshelf
LI14	A2	User interface must be 3-4 ft from ground level
LI14	A2	Must be operable with one hand and begin process no more than 10 sec after first user input
LI14	A2	Must leave all pages and covers of books intact and mark-free after retrieval
LI14	A2	Must retrieve books from ground level up to 6.5 ft high (anywhere in between)
LI14	A2	Must operate at 50 dB or below
LI14	A2	Must secure to vertical side-wall of bookshelf and occupy <= 60 in^2 of space and said wall
LI14	A2	Must retrieve book in 15 sec or less from initial movement
LI14	A2	Must have all wiring and hinges covered and protected, aesthetically pleasing exterior
LI14	A2	Must be battery powered with a lofe of >= 48 hours of continuous operation
LI14	A2	Must be able to be installed within two hours
LI14	A2	Must weigh under 150 lbs, excluding battery
CH11	A2	Range between seated height of 6 ft
CH11	A2	Safe to use (won't drop books)
CH11	A2	Convenient (hand operated)
CH11	A2	Precise controls to not damage books
CH11	A2	Fits standard bookshelf (research dimensions)
CH11	A2	Smooth mechanics (simple motion)
CH11	A2	Enough force for heavy books

CH11	A2	Easy to maintain (clean/common parts used)
CH11	A2	Easy to install (to level of library maintenance worker)
CH11	A2	Cost effective (easy to manufacture in bulk)
TE30	A2	Reach at least 6 ft, but also other intermediate heights
TE30	A2	Wheelchair friendly
TE30	A2	Sturdy enough for repeated abuse/use
TE30	A2	No harm to use (no pinched fingers/hands)
TE30	A2	Easily stored on wheelchair when not in use (if wheelchair mounted)
TE30	A2	Possibly collapse (for ease of storage)
TE30	A2	No damage to books
TE30	A2	No damage to bookshelf
TE30	A2	Easy to use with one hand (by wheelchair occupant)
TE30	A2	Lightweight
TE30	A2	Has sturdy grip on books
TE30	A2	Quiet if mechanized, as will be in library
TE30	A2	Should be accurate enough to retrieve specific book
MA01b	A2	Must be able to reach top shelf of bookshelf
MA01b	A2	Must adhere to set safety requirements
MA01b	A2	Must be convenient (easier to use item than call for help/ use another method)
MA01b	A2	Must not damage books in process (test with many book types)
MA01b	A2	Must be simple enough for layman to install on bookshelf
MA01b	A2	Must meet legal standards (copyright,noise,etc)
MA01b	A2	Should be low decibel in operation (<quiet speaking volume (60db?) for potential use in library)
MA01b	A2	Should be able to reach book in reasonable time (10-30 sec)
MA01b	A2	Should be inexpensive to outfit public library with complete system (<$10000 for large library)
MA01b	A2	Should be teachable to use within 5-10 min
MA01b	A2	Should not interfere with pathways/bookshelf use when not in use
MA01b	A2	Should have safety sensors to prevent damage/injury
BA23	A2	Must be able to fit around 99.9% of books
BA23	A2	Must not interfere with walkway access
BA23	A2	Must be able to be accessible from wheelchair height
BA23	A2	Must have to be able to move across bookshelves
BA23	A2	Must require less than 8 lbs of force to operate
BA23	A2	Must be able to withstand 10000 cycles before failure
BA23	A2	Should present user with indication that a book has been secured
BA23	A2	Should not have pinch points for user
BA23	A2	Should not require excessive movement from operator
BA23	A2	Should be able to be assembled by librarians
BA23	A2	Must fit on a standard US pallet for shipping
BA23	A2	Should have easily interchangeable parts with common fasteners
BA23	A2	Should be able to be disassembled using a screwdriver
BA23	A2	Must cost less than $1000
BA23	A2	Must be able to withstand book weight of up to 8 lbs
KA19	A2	Non complex design
KA19	A2	Ease of manufacturing , no complex tools or large time required
KA19	A2	Cost of manufacturing
KA19	A2	Compatible with most bookshelves
KA19	A2	Ease of use, no high forces to use
KA19	A2	No sharp corners (safety and safety of books)
KA19	A2	Light weight material
KA19	A2	Durable and rigid
KA19	A2	Fixed mounting to shelves
KA19	A2	Operated from low area
KA19	A2	Confirmation of loaded mechanism
KA19	A2	Ergonomics: ease of use, low forces
KA19	A2	Reliable
KA19	A2	Reliably produced
KA19	A2	Easy to assemble
KA19	A2	Shipped in small containers in multiple parts
KA19	A2	Non complex shipping req
KA19	A2	Minimal maintenance necessary
KA19	A2	Low cost of materials used
KA19	A2	Non toxic materials used within production
KA19	A2	Recyclable materials used
KA19	A2	Non intrusive (small foot print)
KA19	A2	Aesthetically pleasing
TA18	A2	Must install on standard bookshelf
TA18	A2	Needs to be able to put book back
TA18	A2	Must be able to grasp 1 book of varying size
TA18	A2	Must be able to be operated with a joystick
TA18	A2	Must withstand wheelchair impacts
TA18	A2	Must be able to reach 8 ft and lower to 2 ft off ground
TA18	A2	Must be able to be used by someone 4 years old
TA18	A2	Must not damage books
TA18	A2	Needs to be <$50
TA18	A2	Needs to have lights/feedback showing that book is selected and ready to retrieve
TA18	A2	Must have no pinch areas

TA18	A2	Must work in existing libraries/bookstores
TA18	A2	Needs easily replaceable parts
TA18	A2	Must not have exposed grease/oil
DE09	A2	Must allow a wheelchair-bound individual to reach a book on a 6 ft high shelf
DE09	A2	Must be safe for all users (wheelchair or no)
DE09	A2	Must be easily activatable from the wheelchair
DE09	A2	Must not cause sudden motions for the user
DE09	A2	Must not damage an adjacent bookshelf
DE09	A2	Must not require any specialized equipment or training to install, and should come with instructions
DE09	A2	Must not damage any floors it is installed on
DE09	A2	Should be as inexpensive as possible
DE09	A2	Should include a list of readily available spare parts
DE09	A2	Should be transportable by SUV/pickup truck
DE09	A2	Should be powered by a standard USA wall outlet or other readily available
DE09	A2	Must be mass-produceable
KA09	A2	The device should have smooth edges
KA09	A2	The device should be padded
KA09	A2	The device should be mounted securely
KA09	A2	The device should be <7lbs
KA09	A2	The device must reach higher than 6 ft
KA09	A2	The device should move fluidly
KA09	A2	The device must have handles or a handle
KA09	A2	The device should be a simple geometry
KA09	A2	The device must not have to many expensive parts
KA09	A2	The device should quit/silent
KA09	A2	The device should be made of a cheap material for increased manufacturing
KA09	A2	The device must be able to grip a variety of sizes of books
KA09	A2	The device should be strictly machanical for ease of use or maintenance
PE06	A2	Digitize the books. Give wheelchair bound patrons digital access to books
PE06	A2	Hire someone to be available to assist
PE06	A2	Place a button on the shelf, 3 feet from the ground
PE06	A2	Button is silent, but alerts "book assistant"
AS17	A2	Must grab and move books
AS17	A2	Taller than 6 ft (reach)
AS17	A2	Operable by someone in wheelchair
AS17	A2	Quiet enough to not disturb others in library
AS17	A2	Safe to use (does not fall over or apply large forces)
AS17	A2	Easy to use (selecting book and operation)
AS17	A2	Smooth operation
AS17	A2	Does not damage books
AS17	A2	Easy maintenance
RO02	A2	The device shall reach up to 6 ft high
RO02	A2	The device shall attach to most existing bookshelves
RO02	A2	The assembly of the device shall be simple (i.e. less than 5 steps)
RO02	A2	The device shall remain securely attached to the bookshelf during use
RO02	A2	The device shall grab and release books
RO02	A2	The device shall not damage books in any way
RO02	A2	The device shall be simple to use (i.e. no more than 3 control inputs)
RO02	A2	The device shall not require excessive force to operate
TO09	A2	Can fit, disassembled, in the trunk of a car
TO09	A2	Operation simple enough, can be used by children
TO09	A2	Requires less than 5 lbs of force to operate
TO09	A2	Offsets the weight of heavier books
TO09	A2	Does not damage books in any way
TO09	A2	Can withstand 10+ years of use
TO09	A2	Cost less than $50
TO09	A2	Can be assembled by a novice
TO09	A2	Able to slide along the length of the shelf
TO09	A2	Operate silently
TO09	A2	Made of standard parts
TO09	A2	Minimal maintenance
TO09	A2	Does not require electric power
TO09	A2	Performs the book retrieval in less than 10 seconds
TO09	A2	Can also put the book back
SO07	A2	Grip force must be comparative to a normal human hand grabbing a book to avoid damage
SO07	A2	Gripper must have enough friction to account for really glossy books
SO07	A2	Must be usable from a minimum heaight of ~3ft
SO07	A2	Must have method of viewing book titles (camera attached to gripper)
SO07	A2	Needs to be able to withstand bookshelf falling over
SO07	A2	Must be attached sturdily; do not want it falling on customer
SO07	A2	Gripper must be constrained to not move faster than 2in/second
SO07	A2	Must smoothly lower book down so gripper does not drop it
SO07	A2	Must have assistance- caller built in in case of difficulty retrieving book
SO07	A2	Must cost no more than the shelving itself in total to purchase and install: limit to 40% of shelving cost
SO07	A2	Must have return function that is easy to use/sensor operated
SO07	A2	Easy to maintain; use as many commercially available parts as possible
SO07	A2	Able to compact for ease of packaging and transport

BH15	A2	Adjustable to fit different bookshelves
BH15	A2	Must not harm the user or anyone else
BH15	A2	Simple mechanism with few mechanical motions
BH15	A2	Few amount of steps required to assemble
BH15	A2	Assembly can be performed by any adult
BH15	A2	Must move slower than 1m/s so book doesn't fall
BH15	A2	Must be quieter than 20 decibels
BH15	A2	Can be operated with ease by any person in a wheelchair
BH15	A2	Can be operated with minimal user input
BH15	A2	Must complete the motion within 10 seconds
BH15	A2	Should approach the wheelchair at a height and distance close to themselves
BH15	A2	The assembly should not damage the existing bookshelf
BH15	A2	Instructions for assembly should be simple
BH15	A2	Should require little to no maintenance
BH15	A2	Should not use more than xx amount of energy
BH15	A2	Should not be obtrusive to the rest of the bookshelves
BH15	A2	Should be sleek in design/compact
BH15	A2	Should be produced and assembled in less than 10 minutes
BH15	A2	Should be transferable to another bookshelf
CA21	A2	At least 6 ft tall
CA21	A2	Inexpensive
CA21	A2	Quiet
CA21	A2	Layman could use it
CA21	A2	Durable
CA21	A2	Gentle on books
CA21	A2	Must be installed on bookshelves
CA21	A2	Must be able to be uninstalled
CA21	A2	Must be at wheelchair level
CA21	A2	Relatively light
CA21	A2	Require little maintenance
CA21	A2	Maintenance is easy, when necessary
CA21	A2	Sustainable
CA21	A2	Corrosion resistant
CA21	A2	Strong
CA21	A2	As compact as possible
CA21	A2	Mobile on bookshelf
CA21	A2	Must be gentle on bookshelf, itself
CA21	A2	Must not fall from bookshelf
CA21	A2	Should be rendered immobile with switch
CA21	A2	Switch should be obviously located and easy to use
KI10	A2	The mechanism must meet safety standards
KI10	A2	The mechanism must be convenient for people in wheelchairs to use
KI10	A2	The mechanism must operate smoothly and not have the ability to damage locks
KI10	A2	The mechanism should be simple and easy to use/learn to use for a new user
KI10	A2	The mechanism should be easy to install
KI10	A2	The mechanism must help reach books at heights of 6 ft or above
KI10	A2	The mechanism should be lightweight to not affect the shelves
KI10	A2	The mechanism should be relatively inexpensive
KI10	A2	The mechanism should be accessible, (within reach) for users in wheelchairs
KI10	A2	The mechanism should be sturdy
KI10	A2	The mechanism should use attainable material
KI10	A2	The mechanism should be longlasting
KI10	A2	The mechanism should be small enough to not obstruct shelves/books
KI10	A2	The mechanism should have easy to use functions
KI10	A2	The mechanism should be easily transportable/adjustable
KI10	A2	The mechanism should be easy to assemble
JO26	A2	Should not damage user
JO26	A2	Should not damage book
JO26	A2	Should not damage shelf
JO26	A2	Should be operable from wheelchair height
JO26	A2	Should be transferrable to other bookshelves
JO26	A2	Should not be heavy
JO26	A2	Should bring book to 3 ft level
JO26	A2	Should put book back if they don't want it
JO26	A2	Should allow user to see books above eye level
JO26	A2	Should be inexpensive
JO26	A2	Should be quiet (library)
KA10b	A2	Must reach the top level of most bookshelves, >6ft+
KA10b	A2	Mechanism should securely obtain books and drop them <= 0.1% of the time
KA10b	A2	Installation must take <30 min on a standard bookshelf
KA10b	A2	Mechanism should function for >= 100 hrs on a single charge of battery
KA10b	A2	Energy source must be from electricity
KA10b	A2	Material of the mechanism must support loads of +8lbs
KA10b	A2	Design must be applicable to mass production rates (>1000)
KA10b	A2	<1% rejects from quality control post production
KA10b	A2	Fit in a 2'x2'x6' shipping package
KA10b	A2	All parts must be able to be recycled

KA10b	A2	Product cost <= $50 retail
KA10b	A2	1st design iteration: production in < 3 months
DA19	A2	The device must be easy to manufacture
DA19	A2	The device must be easy enough for a child to use
DA19	A2	The device should weigh less than 6 lbs
DA19	A2	The device should be affordable
DA19	A2	The device should be able to grab at least one book at a time
DA19	A2	The device should withstand multiple uses (7100) without failing
DA19	A2	The device should be collapsable
DA19	A2	The device should not pose any potential risks
DA19	A2	The device should extend no more than the height of the bookshelf
DA19	A2	Softpads should be placed on the bookend, as not to damage them
DA19	A2	The device should have limited range of motion
LI09	A2	The assembly must be able to reach the highest point on the bookshelf
LI09	A2	The assembly must not stick out in the hallway more than 10 inches
LI09	A2	The assembly must be strong enough to support the heaviest book the library offers
LI09	A2	The assembly must have a grip to safely secure the book to transport
LI09	A2	The assembly must be adaptable to different size shelves (in terms of mounting/thickness of shelf)
LI09	A2	The assembly must be easy to use by allowing the user to specify which book
LI09	A2	The assembly must use a button to initiate motion
LI09	A2	The assembly must have a safety shutoff switch
LI09	A2	The assembly must be powered by plugging into recepticle
LI09	A2	The assembly must be made of a material that is strong enough to support books but not costly
LI09	A2	The assembly must remain quiet when moving
LI09	A2	The assembly must be lightweight enough that only one person is needed to move/remove it (under 30 lbs)
LI09	A2	The assembly must be user friendly by displaying on a display what book it is retrieving
CH21	A2	An arm must be developed that can extend to 6 ft
CH21	A2	A small camera will be attached to the end to identify books
CH21	A2	A small screen will be used to view the camera
CH21	A2	The entire system must cost less than $200 to manufacture
CH21	A2	The arm shall collapse into a 2 ft length
CH21	A2	The end of the arm will have a book lifting device on it
CH21	A2	The book lifting device shall have three pads, two running perpendicular to another. The two for the sides of the book and one for the bottom
CH21	A2	The lifting device will have felt pads on it to protect the books from damage
CH21	A2	The lift arm shall be one assembly
CH21	A2	The lift arm shall lift up to 15 pounds
CH21	A2	The lift arm shall plug into a 120 V socket
CH21	A2	The lift arm shall be controlled via a directional pad
CH21	A2	The lift arm components shall be constructed of aluminum
SU11A	A2	Must hold 300 lbs
SU11A	A2	Must be simple for all ages to operate
SU11A	A2	Must not damage books
SU11A	A2	Must reach 6 ft
SU11A	A2	Must cost <$100
JO04b	A2	Must be safe to use
JO04b	A2	Must be convenient
JO04b	A2	Must operate smoothly
JO04b	A2	Must not damage the books
JO04b	A2	Must be able to get books from above 6 ft
JO04b	A2	Must be able to be installed on most existing bookshelves
JO04b	A2	Must be easy enough to use by a child
JO04b	A2	Must not impede bookshelf capacity
JO04b	A2	Must be able to pinch up large textbooks (~4 pounds)
JO04b	A2	Must be no larger than the bookshelf
JO04b	A2	Must be able to be assembled quickly
JO04b	A2	Must be quiet enough to use in a library
JO04b	A2	Must be inexpensive (<$20)
JO04b	A2	Must require less than 5 lbs of force to operate
JO04b	A2	Must grab and release books
JO04b	A2	Minimal maintenance
TE05	A2	Must have a slim profile to not detract from the ornamental design of bookshelf
TE05	A2	Must activate only when needed
TE05	A2	Must put itself away easily
TE05	A2	Must weigh less than 10 lbs
TE05	A2	Must not damage the books
TE05	A2	Must operate at a similar speed to a manual book removal operation
TE05	A2	Must remain tightly secure on the bookshelf
TE05	A2	Must not damage the bookshelf
TE05	A2	Must be easily adjusted
TE05	A2	Must be easily removable

Appendix C. Quantity Results

Bookshelf	*Bike Lock*
Problem 1	Problem 2
A1, A2	B1, B2

Minimum viable definition of a requirement for count 3:
For a requirement to be minimally viable, for the purpose of the analysis in count 3, it must have a *clear implied subject and a verb*.

Before Lecture				Before Lecture			
B1				A1			
ID #	**Quantity Raw**		**Minimum Viable Definition**	ID #	**Quantity Raw**		**Minimum Viable Definition**
	Count 1	Count 2	Count 3		Count 1	Count 2	Count 3
AN09	9	9	5	SU08	11	11	11
GI21	8	8	3	MA11a	7	7	7
CH15	12	12	11	SH21	13	12	10
SU02	9	9	9	AL14	11	11	11
LO01	18	18	13	KR20	8	8	7
JU02	7	7	4	MI18	16	16	14
LO03	8	8	8	KA10	10	10	10
AM20	9	9	5	MA11b	7	7	5
MA19	21	21	10	ME11	7	7	7
SA11	9	9	3	WE31	8	8	8
JE06	17	17	13	BE02	6	6	5
JE10	16	16	14	LA04	5	5	5
TA06	15	15	15	MI02	14	14	4
BR02	4	4	4	PA27	8	8	6
AN11	7	7	3	NA21	14	14	12
KA05	8	8	3	MI29	7	7	4
CI26	8	8	1	ML02	4	4	3
LY04	11	11	9	DA02	19	18	8
JE17	9	9	9	KI01	19	19	14
SA06	6	6	3	LI11	8	8	5
MA02	13	13	13	JA12	5	5	5
CA11	8	7	4	LA11	14	14	13
MA01a	4	4	4	LE08	5	5	5
JO04	10	10	9	CH01	9	9	9
LA07	7	7	7	KA02	15	15	13
MI16	8	8	8	SH16	8	8	8
CH02	6	6	6	BA25	9	9	6
LI14	6	6	6	JE11	8	8	8
CH11	11	11	8	MI29a	9	9	9
TE30	11	11	4	MI29b	12	12	12
MA01b	7	7	6	LA03	9	9	8
BA23	11	11	11	SO05	8	8	6

KA19	10	9	1
TA18	11	11	11
DE09	7	7	7
KA09	4	4	4
PE06	13	13	3
AS17	9	9	3
RO02	6	6	6
TO09	9	9	9
SO07	8	8	8
BH15	21	21	11
CA21	11	11	11
KI10	10	10	10
JO26	10	10	5
KA10b	9	9	5
DA19	7	7	7
LI09	7	7	7
CH21	7	7	7
SU11A	5	5	5
JO04b	10	10	10
Average	9.54902	9.509804	7.0784314
Std Dev	3.805639	3.816232	3.4688707

KU92	11	11	9
LA22	13	13	6
SA04	7	7	4
RE05	7	7	3
MA08	5	5	5
SU14	15	15	10
SU11B	10	10	8
TE27	9	9	9
JA04b	7	7	7
VI10	12	12	11
MI09	14	14	14
AN24	14	14	8
DI15	14	14	10
MA22	8	8	7
GI17	7	7	7
AM05	8	8	5
LI04	13	13	7
RE08	10	10	8
GE08	9	9	9
MA15	11	11	6
CH05	8	8	8
VI20	7	7	7
CH06	7	7	6
MA10	3	3	3
JU22	19	19	15
ME12	7	7	7
CH09	13	13	13
KI12	11	11	9
DE15	9	9	4
LI04b	17	17	17
JO24	6	6	6
AN18	7	7	7
ME25	14	14	11
VI01	7	7	7
MA12	14	14	6
KA02b	7	7	3
SA04b	15	15	15
JA04	14	13	13
Average	10.02857	9.985714	8.114285714

After Lecture				After Lecture			
B2				A2			
ID #	**Quantity Raw**		**Minimum Viable Definition**	ID #	**Quantity Raw**		**Minimum Viable Definition**
	Count 1	Count 2	Count 3		Count 1	Count 2	Count 3
SU08	11	11	11	AN09	10	10	6
MA11a	12	12	12	GI21	20	20	17
SH21	14	13	9	CH15	26	26	16
AL14	14	14	14	SU02	13	13	11
KR20	13	13	12	LO01	19	19	19
MI18	18	18	11	JU02	14	14	12
KA10	17	17	17	LO03	11	11	11
MA11b	20	19	15	AM20	7	7	7
ME11	5	5	5	MA19	26	26	14
WE31	10	10	10	SA11	21	21	13
BE02	8	8	6	JE06	21	21	16
LA04	18	18	9	JE10	23	23	23
MI02	17	17	3	TA06	23	23	20
PA27	9	9	6	BR02	5	5	5
NA21	11	11	11	AN11	10	10	6
MI29	11	11	10	KA05	9	9	6
ML02	9	9	8	CI26	17	17	11
DA02	11	11	10	LY04	16	16	16
KI01	15	15	8	JE17	16	16	16
LI11	15	15	9	SA06	17	17	16
JA12	9	9	6	MA02	18	18	18
LA11	15	15	13	CA11	10	10	10
LE08	20	20	19	MA01a	8	12	12
CH01	12	12	11	JO04	24	24	23
KA02	15	15	14	LA07	17	17	17
SH16	15	15	15	MI16	18	18	14
BA25	14	14	11	CH02	12	12	12
JE11	17	17	17	LI14	13	13	12
MI29a	17	17	14	CH11	10	10	8
MI29b	17	17	17	TE30	13	13	11
LA03	15	15	9	MA01b	12	12	12
SO05	10	10	7	BA23	15	15	15
KU92	18	18	18	KA19	23	23	12
LA22	15	15	5	TA18	14	14	13
SA04	13	13	8	DE09	12	12	12
RE05	10	10	10	KA09	13	13	12
MA08	9	9	9	PE06	4	4	4
SU14	18	18	13	AS17	9	9	6
SU11B	17	17	11	RO02	8	8	8
TE27	16	16	16	TO09	15	15	14
JA04b	13	13	6	SO07	13	13	13
VI10	11	11	10	BH15	19	19	18
MI09	13	13	13	CA21	21	21	10
AN24	18	18	10	KI10	16	16	16
DI15	15	15	9	JO26	11	11	11
MA22	13	13	11	KA10b	12	12	10
GI17	8	8	7	DA19	11	11	11

AM05	10	10	7
LI04	9	9	7
RE08	8	8	8
GE08	12	11	11
MA15	14	14	11
CH05	17	17	17
VI20	9	9	8
CH06	16	16	15
MA10	14	14	14
JU22	22	22	20
ME12	7	7	7
CH09	15	15	15
KI12	19	19	17
DE15	19	19	12
LI04b	25	25	25
JO24	8	8	7
AN18	33	33	33
ME25	14	14	8
VI01	18	18	18
MA12	18	18	14
KA02b	12	12	4
SA04b	15	15	15
JA04	19	19	19
Average	14.2	14.15714	11.67142857

LI09	13	13	13
CH21	14	13	13
SU11A	5	5	5
JO04b	16	16	15
TE05	10	10	10
Average	14.56863	14.62745	12.5686275
Std Dev	5.369686	5.306159	4.36678597

Appendix D. Completeness Results

ID	P-Code	S (1pt.)	V (1 pt.)	M auto (1/2pt.)	Total Score
AN09	B1	0	1	0	1
AN09	B1	0	0	0	0
AN09	B1	0	0	0	0
AN09	B1	0	1	0	1
AN09	B1	0	1	0	1
AN09	B1	0	1	0	1
AN09	B1	0	0	0	0
AN09	B1	0	0	0	0
AN09	B1	0	1	0	1
GI21	B1	1	1	0.5	2.5
GI21	B1	0	0	0	0
GI21	B1	0	0	0	0
GI21	B1	0	1	0	1
GI21	B1	0	0	0	0
GI21	B1	0	1	0	1
GI21	B1	0	0	0	0
GI21	B1	0	1	0	1
CH15	B1	1	1	0.5	2.5
CH15	B1	1	1	0	2
CH15	B1	0	1	0.5	1.5
CH15	B1	0	1	0	1
CH15	B1	1	1	0	2
CH15	B1	1	1	0	2
CH15	B1	1	1	0.5	2.5
CH15	B1	1	1	0	2
CH15	B1	0	1	0	1
CH15	B1	0	1	0.5	1.5
CH15	B1	0	0	0	0
CH15	B1	0	1	0.5	1.5
SU02	B1	1	1	0.5	2.5
SU02	B1	1	1	0.5	2.5
SU02	B1	1	1	0.5	2.5
SU02	B1	1	1	0.5	2.5
SU02	B1	1	1	0.5	2.5
SU02	B1	1	1	0.5	2.5
SU02	B1	1	1	0.5	2.5
SU02	B1	0	1	0.5	1.5
SU02	B1	0	1	0.5	1.5
LO01	B1	0	0	0	0
LO01	B1	0	0	0	0
LO01	B1	0	0	0	0
LO01	B1	0	0	0	0
LO01	B1	0	1	0	1
LO01	B1	0	1	0.5	1.5
LO01	B1	0	1	0.5	1.5
LO01	B1	0	1	0.5	1.5
LO01	B1	1	0	0	1
LO01	B1	0	1	0	1
LO01	B1	0	1	0.5	1.5
LO01	B1	0	1	0	1
LO01	B1	0	1	0	1
LO01	B1	1	1	0.5	2.5
LO01	B1	0	1	0.5	1.5
LO01	B1	0	1	0.5	1.5
LO01	B1	0	1	0.5	1.5
LO01	B1	0	1	0.5	1.5
JU02	B1	1	0	0	1
JU02	B1	0	1	0.5	1.5
JU02	B1	0	0	0	0
JU02	B1	0	1	0	1

JU02	B1	0	0	0	0
JU02	B1	0	1	0	1
JU02	B1	0	1	0	1
LO03	B1	1	1	0.5	2.5
LO03	B1	1	1	0.5	2.5
LO03	B1	1	1	0.5	2.5
LO03	B1	1	1	0.5	2.5
LO03	B1	1	1	0.5	2.5
LO03	B1	1	1	0.5	2.5
LO03	B1	1	1	0.5	2.5
LO03	B1	1	1	0.5	2.5
AM20	B1	0	0	0	0
AM20	B1	0	0	0	0
AM20	B1	0	0	0	0
AM20	B1	0	1	0.5	1.5
AM20	B1	0	1	0.5	1.5
AM20	B1	1	0	0	1
AM20	B1	0	1	0	1
AM20	B1	1	1	0.5	2.5
AM20	B1	0	1	0.5	1.5
MA19	B1	1	1	0.5	2.5
MA19	B1	0	0	0	0
MA19	B1	0	0	0	0
MA19	B1	0	0	0	0
MA19	B1	0	0	0	0
MA19	B1	0	0	0	0
MA19	B1	0	1	0.5	1.5
MA19	B1	0	0	0	0
MA19	B1	0	1	0.5	1.5
MA19	B1	1	1	0.5	2.5
MA19	B1	0	1	0	1
MA19	B1	0	1	0	1
MA19	B1	0	1	0	1
MA19	B1	0	0	0	0
MA19	B1	0	0	0	0
MA19	B1	0	1	0	1
MA19	B1	0	1	0.5	1.5
MA19	B1	0	0	0	0
MA19	B1	0	1	0.5	1.5
MA19	B1	0	0	0	0
MA19	B1	0	1	0	1
SA11	B1	0	1	0	1
SA11	B1	0	0	0	0
SA11	B1	0	0	0	0
SA11	B1	0	1	0	1
SA11	B1	0	0	0	0
SA11	B1	0	0	0	0
SA11	B1	0	0	0	0
SA11	B1	0	1	0	1
SA11	B1	0	0	0	0
JE06	B1	0	1	0	1
JE06	B1	0	1	0.5	1.5
JE06	B1	0	1	0	1
JE06	B1	0	1	0.5	1.5
JE06	B1	0	0	0	0
JE06	B1	0	0	0	0
JE06	B1	0	0	0	0
JE06	B1	0	1	0	1
JE06	B1	0	1	0.5	1.5
JE06	B1	0	1	0	1
JE06	B1	0	1	0.5	1.5
JE06	B1	0	1	0	1
JE06	B1	0	1	0	1
JE06	B1	0	1	0.5	1.5
JE06	B1	0	0	0	0

JE06	B1	0	1	0	1
JE06	B1	0	1	0	1
JE10	B1	1	1	0.5	2.5
JE10	B1	0	1	0.5	1.5
JE10	B1	0	1	0.5	1.5
JE10	B1	1	1	0.5	2.5
JE10	B1	1	1	0	2
JE10	B1	1	1	0.5	2.5
JE10	B1	1	1	0.5	2.5
JE10	B1	0	1	0.5	1.5
JE10	B1	0	1	0.5	1.5
JE10	B1	0	1	0.5	1.5
JE10	B1	0	1	0.5	1.5
JE10	B1	0	1	0.5	1.5
JE10	B1	0	1	0.5	1.5
JE10	B1	0	1	0.5	1.5
JE10	B1	0	1	0.5	1.5
JE10	B1	0	1	0.5	1.5
TA06	B1	0	1	0.5	1.5
TA06	B1	0	1	0.5	1.5
TA06	B1	0	1	0.5	1.5
TA06	B1	0	1	0.5	1.5
TA06	B1	0	1	0.5	1.5
TA06	B1	0	1	0.5	1.5
TA06	B1	0	1	0.5	1.5
TA06	B1	0	1	0.5	1.5
TA06	B1	0	1	0.5	1.5
TA06	B1	0	1	0.5	1.5
TA06	B1	0	1	0.5	1.5
TA06	B1	0	1	0.5	1.5
TA06	B1	0	1	0.5	1.5
TA06	B1	0	1	0.5	1.5
TA06	B1	0	1	0.5	1.5
BR02	B1	1	1	0.5	2.5
BR02	B1	1	1	0.5	2.5
BR02	B1	1	1	0.5	2.5
BR02	B1	1	1	0.5	2.5
AN11	B1	0	0	0	0
AN11	B1	0	0	0	0
AN11	B1	0	1	0.5	1.5
AN11	B1	0	1	0	1
AN11	B1	0	0	0	0
AN11	B1	0	0	0	0
AN11	B1	0	1	0.5	1.5
KA05	B1	0	1	0.5	1.5
KA05	B1	0	0	0	0
KA05	B1	0	0	0	0
KA05	B1	0	0	0	0
KA05	B1	0	1	0	1
KA05	B1	0	0	0	0
KA05	B1	0	0	0	0
KA05	B1	0	1	0.5	1.5
CI26	B1	1	0	0	1
CI26	B1	0	1	0	1
CI26	B1	0	0	0	0
CI26	B1	0	0	0	0
CI26	B1	0	0	0	0
CI26	B1	0	0	0	0
CI26	B1	0	0	0	0
CI26	B1	0	0	0	0
LY04	B1	0	1	0	1
LY04	B1	0	1	0.5	1.5
LY04	B1	0	1	0.5	1.5
LY04	B1	0	1	0	1
LY04	B1	0	0	0	0

LY04	B1	0	0	0	0
LY04	B1	0	1	0	1
LY04	B1	0	1	0	1
LY04	B1	0	1	0.5	1.5
LY04	B1	0	1	0	1
LY04	B1	0	1	0	1
JE17	B1	1	1	0.5	2.5
JE17	B1	0	1	0.5	1.5
JE17	B1	0	1	0.5	1.5
JE17	B1	0	1	0.5	1.5
JE17	B1	0	1	0.5	1.5
JE17	B1	0	1	0.5	1.5
JE17	B1	0	1	0.5	1.5
JE17	B1	0	1	0.5	1.5
JE17	B1	0	1	0.5	1.5
SA06	B1	1	1	0	2
SA06	B1	0	1	0.5	1.5
SA06	B1	0	1	0.5	1.5
SA06	B1	0	1	0.5	1.5
SA06	B1	0	0	0	0
SA06	B1	0	0	0	0
MA02	B1	0	1	0.5	1.5
MA02	B1	0	1	0.5	1.5
MA02	B1	0	1	0.5	1.5
MA02	B1	0	1	0.5	1.5
MA02	B1	0	1	0.5	1.5
MA02	B1	0	1	0.5	1.5
MA02	B1	1	1	0.5	2.5
MA02	B1	0	1	0.5	1.5
MA02	B1	0	1	0	1
MA02	B1	0	1	0.5	1.5
MA02	B1	0	1	0.5	1.5
MA02	B1	0	1	0.5	1.5
MA02	B1	0	1	0.5	1.5
CA11	B1	0	1	0	1
CA11	B1	0	1	0.5	1.5
CA11	B1	0	0	0	0
CA11	B1	1	1	0.5	2.5
CA11	B1	0	1	0.5	1.5
CA11	B1	0	0	0	0
CA11	B1	0	0	0	0
MA01a	B1	1	1	0.5	2.5
MA01a	B1	1	1	0.5	2.5
MA01a	B1	1	1	0.5	2.5
MA01a	B1	1	1	0.5	2.5
JO04	B1	0	0	0	0
JO04	B1	1	1	0.5	2.5
JO04	B1	1	1	0.5	2.5
JO04	B1	1	1	0.5	2.5
JO04	B1	1	1	0	2
JO04	B1	1	1	0	2
JO04	B1	1	1	0.5	2.5
JO04	B1	1	1	0.5	2.5
JO04	B1	1	1	0.5	2.5
JO04	B1	1	1	0.5	2.5
LA07	B1	0	1	0.5	1.5
LA07	B1	0	1	0.5	1.5
LA07	B1	0	1	0.5	1.5
LA07	B1	0	1	0.5	1.5
LA07	B1	0	1	0.5	1.5
LA07	B1	0	1	0.5	1.5
LA07	B1	0	1	0.5	1.5
MI16	B1	0	1	0	1
MI16	B1	0	1	0	1
MI16	B1	0	1	0	1

MI16	B1	0	1	0.5	1.5
MI16	B1	0	1	0.5	1.5
MI16	B1	0	1	0.5	1.5
MI16	B1	0	1	0	1
MI16	B1	0	1	0	1
CH02	B1	0	1	0.5	1.5
CH02	B1	0	1	0.5	1.5
CH02	B1	0	1	0.5	1.5
CH02	B1	0	1	0	1
CH02	B1	1	1	0.5	2.5
CH02	B1	0	1	0.5	1.5
LI14	B1	0	1	0.5	1.5
LI14	B1	0	1	0	1
LI14	B1	0	1	0.5	1.5
LI14	B1	0	1	0.5	1.5
LI14	B1	0	1	0.5	1.5
LI14	B1	0	1	0.5	1.5
CH11	B1	0	1	0.5	1.5
CH11	B1	0	1	0.5	1.5
CH11	B1	0	0	0	0
CH11	B1	0	1	0	1
CH11	B1	0	1	0	1
CH11	B1	0	0	0	0
CH11	B1	0	0	0	0
CH11	B1	0	1	0	1
CH11	B1	0	1	0.5	1.5
CH11	B1	0	1	0.5	1.5
CH11	B1	0	1	0	1
TE30	B1	0	0	0	0
TE30	B1	0	0	0	0
TE30	B1	0	1	0.5	1.5
TE30	B1	0	0	0	0
TE30	B1	0	0	0	0
TE30	B1	0	1	0.5	1.5
TE30	B1	0	0	0	0
TE30	B1	0	0	0	0
TE30	B1	0	1	0	1
TE30	B1	0	1	0	1
TE30	B1	1	0	0	1
MA01b	B1	1	0	0	1
MA01b	B1	0	1	0.5	1.5
MA01b	B1	0	1	0.5	1.5
MA01b	B1	0	1	0.5	1.5
MA01b	B1	0	1	0.5	1.5
MA01b	B1	0	1	0.5	1.5
MA01b	B1	0	1	0	1
BA23	B1	1	1	0.5	2.5
BA23	B1	1	1	0.5	2.5
BA23	B1	1	1	0.5	2.5
BA23	B1	1	1	0.5	2.5
BA23	B1	1	1	0.5	2.5
BA23	B1	1	1	0.5	2.5
BA23	B1	1	1	0.5	2.5
BA23	B1	1	1	0.5	2.5
BA23	B1	1	1	0.5	2.5
BA23	B1	1	1	0.5	2.5
BA23	B1	1	1	0.5	2.5
KA19	B1	0	1	0.5	1.5
KA19	B1	0	0	0	0
KA19	B1	0	0	0	0
KA19	B1	0	0	0	0
KA19	B1	0	0	0	0
KA19	B1	0	0	0	0
KA19	B1	0	0	0	0
KA19	B1	0	0	0	0

KA19	B1	0	0	0	0
TA18	B1	0	1	0.5	1.5
TA18	B1	0	1	0.5	1.5
TA18	B1	0	1	0.5	1.5
TA18	B1	0	1	0.5	1.5
TA18	B1	0	1	0.5	1.5
TA18	B1	0	1	0.5	1.5
TA18	B1	1	1	0.5	2.5
TA18	B1	0	1	0	1
TA18	B1	0	1	0.5	1.5
TA18	B1	0	1	0	1
TA18	B1	0	1	0	1
DE09	B1	0	1	0.5	1.5
DE09	B1	0	1	0.5	1.5
DE09	B1	0	1	0.5	1.5
DE09	B1	0	1	0.5	1.5
DE09	B1	0	1	0.5	1.5
DE09	B1	0	1	0.5	1.5
DE09	B1	0	1	0.5	1.5
KA09	B1	1	1	0	2
KA09	B1	0	1	0	1
KA09	B1	0	1	0	1
KA09	B1	0	1	0	1
PE06	B1	1	0	0	1
PE06	B1	0	0	0	0
PE06	B1	0	0	0	0
PE06	B1	0	0	0	0
PE06	B1	0	1	0	1
PE06	B1	0	0	0	0
PE06	B1	0	1	0.5	1.5
PE06	B1	0	1	0.5	1.5
PE06	B1	0	0	0	0
PE06	B1	0	0	0	0
PE06	B1	0	0	0	0
PE06	B1	1	0	0	1
PE06	B1	1	0	0	1
AS17	B1	0	1	0	1
AS17	B1	0	1	0	1
AS17	B1	0	0	0	0
AS17	B1	0	0	0	0
AS17	B1	0	0	0	0
AS17	B1	0	0	0	0
AS17	B1	0	0	0	0
AS17	B1	0	0	0	0
AS17	B1	0	1	0	1
RO02	B1	1	1	0.5	2.5
RO02	B1	1	1	0.5	2.5
RO02	B1	1	1	0.5	2.5
RO02	B1	1	1	0.5	2.5
RO02	B1	1	1	0.5	2.5
RO02	B1	1	1	0.5	2.5
TO09	B1	1	1	0.5	2.5
TO09	B1	1	1	0.5	2.5
TO09	B1	1	1	0.5	2.5
TO09	B1	1	1	0.5	2.5
TO09	B1	1	1	0.5	2.5
TO09	B1	1	1	0.5	2.5
TO09	B1	1	1	0.5	2.5
TO09	B1	1	1	0.5	2.5
TO09	B1	1	1	0.5	2.5
SO07	B1	0	1	0.5	1.5
SO07	B1	0	1	0.5	1.5
SO07	B1	0	1	0	1
SO07	B1	1	1	0.5	2.5
SO07	B1	0	1	0.5	1.5

SO07	B1	1	1	0.5	2.5
SO07	B1	1	1	0.5	2.5
SO07	B1	0	1	0.5	1.5
BH15	B1	0	1	0.5	1.5
BH15	B1	0	1	0.5	1.5
BH15	B1	0	1	0.5	1.5
BH15	B1	0	1	0.5	1.5
BH15	B1	0	0	0	0
BH15	B1	0	0	0	0
BH15	B1	0	0	0	0
BH15	B1	0	0	0	0
BH15	B1	0	0	0	0
BH15	B1	0	1	0	1
BH15	B1	0	1	0.5	1.5
BH15	B1	0	0	0	0
BH15	B1	0	0	0	0
BH15	B1	0	0	0	0
BH15	B1	0	1	0	1
BH15	B1	0	1	0.5	1.5
BH15	B1	0	1	0.5	1.5
BH15	B1	0	0	0	0
BH15	B1	0	1	0.5	1.5
BH15	B1	0	1	0.5	1.5
BH15	B1	0	0	0	0
CA21	B1	0	1	0.5	1.5
CA21	B1	0	1	0.5	1.5
CA21	B1	0	1	0.5	1.5
CA21	B1	0	1	0.5	1.5
CA21	B1	0	1	0.5	1.5
CA21	B1	0	1	0.5	1.5
CA21	B1	0	1	0.5	1.5
CA21	B1	0	1	0.5	1.5
CA21	B1	0	1	0.5	1.5
CA21	B1	0	1	0.5	1.5
CA21	B1	0	1	0.5	1.5
KI10	B1	1	1	0.5	2.5
KI10	B1	1	1	0.5	2.5
KI10	B1	1	1	0.5	2.5
KI10	B1	1	1	0.5	2.5
KI10	B1	1	1	0.5	2.5
KI10	B1	1	1	0.5	2.5
KI10	B1	1	1	0.5	2.5
KI10	B1	1	1	0.5	2.5
KI10	B1	1	1	0.5	2.5
KI10	B1	1	1	0.5	2.5
JO26	B1	0	1	0	1
JO26	B1	0	1	0.5	1.5
JO26	B1	0	1	0.5	1.5
JO26	B1	0	0	0	0
JO26	B1	0	0	0	0
JO26	B1	0	0	0	0
JO26	B1	0	0	0	0
JO26	B1	0	0	0	0
JO26	B1	1	1	0	2
JO26	B1	1	1	0	2
KA10b	B1	1	0	0	1
KA10b	B1	0	1	0	1
KA10b	B1	0	0	0	0
KA10b	B1	0	1	0	1
KA10b	B1	0	0	0	0
KA10b	B1	0	1	0	1
KA10b	B1	0	0	0	0
KA10b	B1	0	1	0	1
KA10b	B1	0	1	0	1
DA19	B1	1	1	0.5	2.5

DA19	B1	1	1	0.5	2.5
DA19	B1	1	1	0.5	2.5
DA19	B1	1	1	0.5	2.5
DA19	B1	1	1	0.5	2.5
DA19	B1	1	1	0.5	2.5
DA19	B1	1	1	0.5	2.5
LI09	B1	1	1	0.5	2.5
LI09	B1	1	1	0.5	2.5
LI09	B1	1	1	0.5	2.5
LI09	B1	1	1	0.5	2.5
LI09	B1	1	1	0.5	2.5
LI09	B1	1	1	0.5	2.5
LI09	B1	1	1	0.5	2.5
CH21	B1	1	1	0.5	2.5
CH21	B1	1	1	0.5	2.5
CH21	B1	1	1	0.5	2.5
CH21	B1	1	1	0.5	2.5
CH21	B1	1	1	0.5	2.5
CH21	B1	1	1	0.5	2.5
CH21	B1	1	1	0.5	2.5
SU11A	B1	1	1	0.5	2.5
SU11A	B1	1	1	0.5	2.5
SU11A	B1	1	1	0.5	2.5
SU11A	B1	1	1	0.5	2.5
SU11A	B1	1	1	0.5	2.5
JO04b	B1	1	1	0	2
JO04b	B1	1	1	0.5	2.5
JO04b	B1	1	1	0.5	2.5
JO04b	B1	1	1	0.5	2.5
JO04b	B1	1	1	0.5	2.5
JO04b	B1	1	1	0.5	2.5
JO04b	B1	1	1	0.5	2.5
JO04b	B1	1	1	0.5	2.5
JO04b	B1	1	1	0.5	2.5
JO04b	B1	1	1	0.5	2.5
SU08	A1	0	1	0	1
SU08	A1	1	1	0.5	2.5
SU08	A1	0	1	0.5	1.5
SU08	A1	1	1	0.5	2.5
SU08	A1	0	1	0.5	1.5
SU08	A1	1	1	0.5	2.5
SU08	A1	0	1	0.5	1.5
SU08	A1	0	1	0.5	1.5
SU08	A1	0	1	0.5	1.5
SU08	A1	0	1	0.5	1.5
SU08	A1	0	1	0.5	1.5
MA11a	A1	0	1	0	1
MA11a	A1	0	1	0	1
MA11a	A1	0	1	0	1
MA11a	A1	0	1	0.5	1.5
MA11a	A1	0	1	0.5	1.5
MA11a	A1	0	1	0.5	1.5
MA11a	A1	0	1	0	1
SH21	A1	0	1	0.5	1.5
SH21	A1	0	1	0.5	1.5
SH21	A1	0	1	0	1
SH21	A1	0	0	0	0
SH21	A1	0	0	0	0
SH21	A1	0	1	0	1
SH21	A1	0	1	0.5	1.5
SH21	A1	0	1	0.5	1.5
SH21	A1	0	1	0.5	1.5
SH21	A1	0	1	0.5	1.5
SH21	A1	0	1	0	1
SH21	A1	1	1	0.5	2.5

AL14	A1	0	1	0.5	1.5
AL14	A1	0	1	0.5	1.5
AL14	A1	0	1	0.5	1.5
AL14	A1	0	1	0.5	1.5
AL14	A1	0	1	0.5	1.5
AL14	A1	0	1	0.5	1.5
AL14	A1	0	1	0.5	1.5
AL14	A1	1	1	0.5	2.5
AL14	A1	0	1	0.5	1.5
AL14	A1	0	1	0.5	1.5
AL14	A1	0	1	0.5	1.5
KR20	A1	0	1	0.5	1.5
KR20	A1	0	1	0	1
KR20	A1	0	1	0.5	1.5
KR20	A1	1	0	0	1
KR20	A1	0	1	0	1
KR20	A1	0	1	0.5	1.5
KR20	A1	1	1	0.5	2.5
KR20	A1	0	1	0.5	1.5
MI18	A1	0	1	0	1
MI18	A1	1	1	0	2
MI18	A1	1	1	0	2
MI18	A1	0	1	0.5	1.5
MI18	A1	0	1	0	1
MI18	A1	0	1	0	1
MI18	A1	0	0	0	0
MI18	A1	0	0	0	0
MI18	A1	0	1	0	1
MI18	A1	1	1	0	2
MI18	A1	0	1	0	1
MI18	A1	1	1	0	2
MI18	A1	1	1	0.5	2.5
MI18	A1	1	1	0.5	2.5
MI18	A1	0	1	0.5	1.5
MI18	A1	0	1	0	1
KA10	A1	1	1	0.5	2.5
KA10	A1	1	1	0.5	2.5
KA10	A1	1	1	0.5	2.5
KA10	A1	1	1	0.5	2.5
KA10	A1	1	1	0.5	2.5
KA10	A1	1	1	0.5	2.5
KA10	A1	1	1	0.5	2.5
KA10	A1	1	1	0.5	2.5
KA10	A1	1	1	0.5	2.5
KA10	A1	1	1	0.5	2.5
MA11b	A1	0	0	0	0
MA11b	A1	0	1	0.5	1.5
MA11b	A1	0	1	0.5	1.5
MA11b	A1	0	1	0.5	1.5
MA11b	A1	0	0	0	0
MA11b	A1	0	1	0.5	1.5
MA11b	A1	0	1	0	1
ME11	A1	1	1	0.5	2.5
ME11	A1	1	1	0.5	2.5
ME11	A1	1	1	0.5	2.5
ME11	A1	1	1	0.5	2.5
ME11	A1	1	1	0.5	2.5
ME11	A1	1	1	0.5	2.5
ME11	A1	1	1	0.5	2.5
WE31	A1	1	1	0	2
WE31	A1	1	1	0.5	2.5
WE31	A1	1	1	0	2
WE31	A1	1	1	0.5	2.5
WE31	A1	1	1	0.5	2.5
WE31	A1	1	1	0.5	2.5

WE31	A1	1	1	0	2
WE31	A1	1	1	0	2
BE02	A1	0	1	0.5	1.5
BE02	A1	0	1	0.5	1.5
BE02	A1	0	1	0	1
BE02	A1	0	0	0	0
BE02	A1	0	1	0	1
BE02	A1	0	1	0	1
LA04	A1	0	1	0.5	1.5
LA04	A1	0	1	0.5	1.5
LA04	A1	1	1	0.5	2.5
LA04	A1	1	1	0.5	2.5
LA04	A1	1	1	0.5	2.5
MI02	A1	0	0	0	0
MI02	A1	0	0	0	0
MI02	A1	0	0	0	0
MI02	A1	0	0	0	0
MI02	A1	0	0	0	0
MI02	A1	0	0	0	0
MI02	A1	0	0	0	0
MI02	A1	0	1	0	1
MI02	A1	0	1	0	1
MI02	A1	0	0	0	0
MI02	A1	0	0	0	0
MI02	A1	0	1	0	1
MI02	A1	0	1	0	1
MI02	A1	0	0	0	0
PA27	A1	0	0	0	0
PA27	A1	0	0	0	0
PA27	A1	0	1	0	1
PA27	A1	0	1	0	1
PA27	A1	0	1	0	1
PA27	A1	0	1	0	1
PA27	A1	0	1	0.5	1.5
PA27	A1	0	1	0	1
NA21	A1	1	1	0.5	2.5
NA21	A1	0	1	0.5	1.5
NA21	A1	0	1	0.5	1.5
NA21	A1	1	1	0.5	2.5
NA21	A1	0	0	0	0
NA21	A1	0	0	0	0
NA21	A1	1	1	0	2
NA21	A1	0	1	0	1
NA21	A1	1	1	0	2
NA21	A1	0	1	0.5	1.5
NA21	A1	1	1	0.5	2.5
NA21	A1	1	1	0	2
NA21	A1	1	1	0	2
NA21	A1	1	1	0.5	2.5
MI29	A1	0	0	0	0
MI29	A1	0	0	0	0
MI29	A1	0	1	0	1
MI29	A1	0	1	0	1
MI29	A1	0	1	0.5	1.5
MI29	A1	0	0	0	0
MI29	A1	0	1	0.5	1.5
ML02	A1	0	1	0	1
ML02	A1	0	1	0	1
ML02	A1	0	1	0	1
ML02	A1	0	0	0	0
DA02	A1	0	1	0.5	1.5
DA02	A1	0	0	0	0
DA02	A1	0	1	0.5	1.5
DA02	A1	0	1	0.5	1.5
DA02	A1	0	0	0	0

DA02	A1	0	0	0	0
DA02	A1	0	1	0	1
DA02	A1	0	0	0	0
DA02	A1	0	1	0	1
DA02	A1	0	0	0	0
DA02	A1	0	1	0	1
DA02	A1	0	1	0.5	1.5
DA02	A1	1	0	0	1
DA02	A1	0	0	0	0
DA02	A1	0	0	0	0
DA02	A1	0	1	0.5	1.5
DA02	A1	0	1	0	1
DA02	A1	0	0	0	0
KI01	A1	0	1	0.5	1.5
KI01	A1	0	0	0	0
KI01	A1	0	0	0	0
KI01	A1	0	1	0	1
KI01	A1	0	0	0	0
KI01	A1	0	0	0	0
KI01	A1	0	1	0	1
KI01	A1	0	0	0	0
KI01	A1	0	1	0	1
KI01	A1	0	1	0	1
KI01	A1	0	1	0	1
KI01	A1	1	1	0	2
KI01	A1	0	1	0	1
KI01	A1	0	1	0	1
KI01	A1	0	1	0	1
KI01	A1	0	1	0.5	1.5
KI01	A1	0	1	0	1
KI01	A1	0	1	0	1
KI01	A1	0	1	0	1
LI11	A1	0	0	0	0
LI11	A1	0	1	0	1
LI11	A1	0	0	0	0
LI11	A1	0	1	0	1
LI11	A1	0	0	0	0
LI11	A1	0	1	0.5	1.5
LI11	A1	0	1	0	1
LI11	A1	0	1	0.5	1.5
JA12	A1	0	1	0	1
JA12	A1	0	1	0	1
JA12	A1	0	1	0	1
JA12	A1	0	1	0.5	1.5
JA12	A1	0	1	0	1
LA11	A1	0	1	0.5	1.5
LA11	A1	0	1	0.5	1.5
LA11	A1	0	1	0.5	1.5
LA11	A1	0	1	0.5	1.5
LA11	A1	1	1	0.5	2.5
LA11	A1	1	1	0.5	2.5
LA11	A1	1	1	0.5	2.5
LA11	A1	1	1	0.5	2.5
LA11	A1	1	1	0.5	2.5
LA11	A1	0	1	0.5	1.5
LA11	A1	0	1	0.5	1.5
LA11	A1	0	1	0	1
LA11	A1	1	1	0.5	2.5
LA11	A1	1	0	0	1
LE08	A1	0	1	0.5	1.5
LE08	A1	0	1	0.5	1.5
LE08	A1	0	1	0	1
LE08	A1	1	1	0	2
LE08	A1	1	1	0	2
CH01	A1	0	1	0.5	1.5

CH01	A1	0	1	0.5	1.5
CH01	A1	0	1	0.5	1.5
CH01	A1	0	1	0.5	1.5
CH01	A1	0	1	0.5	1.5
CH01	A1	0	1	0.5	1.5
CH01	A1	0	1	0.5	1.5
CH01	A1	0	1	0.5	1.5
CH01	A1	0	1	0.5	1.5
KA02	A1	0	1	0	1
KA02	A1	0	1	0	1
KA02	A1	0	0	0	0
KA02	A1	0	0	0	0
KA02	A1	0	1	0	1
KA02	A1	0	1	0	1
KA02	A1	0	1	0	1
KA02	A1	0	1	0.5	1.5
KA02	A1	0	1	0.5	1.5
KA02	A1	0	1	0.5	1.5
KA02	A1	0	1	0.5	1.5
KA02	A1	0	1	0.5	1.5
KA02	A1	0	1	0	1
KA02	A1	0	1	0	1
KA02	A1	0	1	0.5	1.5
SH16	A1	0	1	0.5	1.5
SH16	A1	0	1	0.5	1.5
SH16	A1	0	1	0.5	1.5
SH16	A1	0	1	0.5	1.5
SH16	A1	0	1	0.5	1.5
SH16	A1	0	1	0.5	1.5
SH16	A1	0	1	0.5	1.5
SH16	A1	0	1	0.5	1.5
BA25	A1	0	1	0	1
BA25	A1	0	1	0	1
BA25	A1	1	0	0	1
BA25	A1	0	0	0	0
BA25	A1	0	1	0	1
BA25	A1	0	1	0.5	1.5
BA25	A1	0	0	0	0
BA25	A1	0	1	0	1
BA25	A1	0	1	0	1
JE11	A1	0	1	0.5	1.5
JE11	A1	0	1	0.5	1.5
JE11	A1	0	1	0.5	1.5
JE11	A1	0	1	0.5	1.5
JE11	A1	0	1	0.5	1.5
JE11	A1	0	1	0.5	1.5
JE11	A1	0	1	0.5	1.5
JE11	A1	0	1	0.5	1.5
MI29a	A1	0	1	0.5	1.5
MI29a	A1	0	1	0.5	1.5
MI29a	A1	0	1	0.5	1.5
MI29a	A1	0	1	0.5	1.5
MI29a	A1	0	1	0.5	1.5
MI29a	A1	0	1	0.5	1.5
MI29a	A1	1	1	0.5	2.5
MI29a	A1	1	1	0.5	2.5
MI29a	A1	0	1	0.5	1.5
MI29b	A1	0	1	0.5	1.5
MI29b	A1	0	1	0	1
MI29b	A1	0	1	0	1
MI29b	A1	0	1	0.5	1.5
MI29b	A1	0	1	0.5	1.5
MI29b	A1	0	1	0.5	1.5
MI29b	A1	0	1	0.5	1.5
MI29b	A1	1	1	0	2

MI29b	A1	0	1	0.5	1.5
MI29b	A1	0	1	0.5	1.5
MI29b	A1	0	1	0.5	1.5
MI29b	A1	0	1	0.5	1.5
LA03	A1	1	1	0	2
LA03	A1	1	1	0	2
LA03	A1	1	1	0	2
LA03	A1	1	1	0	2
LA03	A1	1	1	0	2
LA03	A1	1	1	0	2
LA03	A1	1	1	0.5	2.5
LA03	A1	1	0	0	1
LA03	A1	1	1	0	2
SO05	A1	0	1	0	1
SO05	A1	0	1	0.5	1.5
SO05	A1	0	0	0	0
SO05	A1	0	1	0	1
SO05	A1	0	1	0	1
SO05	A1	0	0	0	0
SO05	A1	0	1	0.5	1.5
SO05	A1	0	1	0.5	1.5
KU92	A1	0	1	0.5	1.5
KU92	A1	0	1	0	1
KU92	A1	0	0	0	0
KU92	A1	0	0	0	0
KU92	A1	1	1	0	2
KU92	A1	1	1	0.5	2.5
KU92	A1	0	1	0	1
KU92	A1	0	1	0.5	1.5
KU92	A1	1	1	0	2
KU92	A1	1	1	0.5	2.5
KU92	A1	1	1	0	2
LA22	A1	1	1	0.5	2.5
LA22	A1	0	1	0.5	1.5
LA22	A1	0	0	0	0
LA22	A1	0	0	0	0
LA22	A1	0	0	0	0
LA22	A1	0	1	0	1
LA22	A1	0	0	0	0
LA22	A1	0	1	0	1
LA22	A1	0	1	0.5	1.5
LA22	A1	0	0	0	0
LA22	A1	0	1	0	1
LA22	A1	0	0	0	0
LA22	A1	0	0	0	0
SA04	A1	0	0	0	0
SA04	A1	0	0	0	0
SA04	A1	0	1	0	1
SA04	A1	0	1	0	1
SA04	A1	0	0	0	0
SA04	A1	0	1	0.5	1.5
SA04	A1	0	1	0	1
RE05	A1	0	0	0	0
RE05	A1	0	1	0	1
RE05	A1	0	0	0	0
RE05	A1	0	1	0	1
RE05	A1	0	0	0	0
RE05	A1	0	0	0	0
RE05	A1	0	1	0	1
MA08	A1	0	1	0.5	1.5
MA08	A1	0	1	0.5	1.5
MA08	A1	0	1	0.5	1.5
MA08	A1	0	1	0.5	1.5
MA08	A1	0	1	0.5	1.5
SU14	A1	0	1	0	1

SU14	A1	0	1	0	1
SU14	A1	0	1	0	1
SU14	A1	0	1	0	1
SU14	A1	0	1	0.5	1.5
SU14	A1	0	0	0	0
SU14	A1	0	0	0	0
SU14	A1	0	1	0	1
SU14	A1	0	0	0	0
SU14	A1	0	0	0	0
SU14	A1	0	1	0	1
SU14	A1	0	1	0.5	1.5
SU14	A1	0	0	0	0
SU14	A1	0	1	0	1
SU14	A1	0	1	0.5	1.5
SU11B	A1	0	1	0	1
SU11B	A1	0	1	0	1
SU11B	A1	0	0	0	0
SU11B	A1	0	0	0	0
SU11B	A1	0	1	0	1
SU11B	A1	0	1	0	1
SU11B	A1	1	1	0	2
SU11B	A1	0	1	0.5	1.5
SU11B	A1	1	1	0	2
SU11B	A1	0	1	0	1
TE27	A1	0	1	0.5	1.5
TE27	A1	0	1	0.5	1.5
TE27	A1	0	1	0.5	1.5
TE27	A1	0	1	0.5	1.5
TE27	A1	0	1	0.5	1.5
TE27	A1	0	1	0.5	1.5
TE27	A1	0	1	0.5	1.5
TE27	A1	0	1	0.5	1.5
TE27	A1	0	1	0.5	1.5
JA04b	A1	0	1	0.5	1.5
JA04b	A1	0	1	0.5	1.5
JA04b	A1	0	1	0.5	1.5
JA04b	A1	0	1	0.5	1.5
JA04b	A1	0	1	0	1
JA04b	A1	0	1	0.5	1.5
JA04b	A1	0	1	0.5	1.5
VI10	A1	0	1	0.5	1.5
VI10	A1	0	1	0.5	1.5
VI10	A1	0	1	0.5	1.5
VI10	A1	0	1	0.5	1.5
VI10	A1	0	1	0.5	1.5
VI10	A1	0	1	0.5	1.5
VI10	A1	0	1	0.5	1.5
VI10	A1	0	1	0.5	1.5
VI10	A1	0	1	0	1
VI10	A1	0	1	0.5	1.5
VI10	A1	0	1	0.5	1.5
VI10	A1	0	0	0	0
MI09	A1	0	1	0.5	1.5
MI09	A1	0	1	0.5	1.5
MI09	A1	0	1	0.5	1.5
MI09	A1	0	1	0.5	1.5
MI09	A1	0	1	0.5	1.5
MI09	A1	0	1	0.5	1.5
MI09	A1	0	1	0.5	1.5
MI09	A1	0	1	0.5	1.5
MI09	A1	0	1	0.5	1.5
MI09	A1	0	1	0.5	1.5
MI09	A1	0	1	0.5	1.5
MI09	A1	0	1	0.5	1.5
MI09	A1	0	1	0.5	1.5

MI09	A1	0	1	0.5	1.5
AN24	A1	0	0	0	0
AN24	A1	0	1	0.5	1.5
AN24	A1	0	1	0	1
AN24	A1	0	0	0	0
AN24	A1	0	0	0	0
AN24	A1	0	0	0	0
AN24	A1	0	0	0	0
AN24	A1	0	1	0	1
AN24	A1	0	0	0	0
AN24	A1	0	1	0	1
AN24	A1	0	1	0.5	1.5
AN24	A1	0	1	0.5	1.5
AN24	A1	0	1	0.5	1.5
AN24	A1	0	1	0.5	1.5
DI15	A1	0	0	0	0
DI15	A1	0	0	0	0
DI15	A1	0	0	0	0
DI15	A1	0	0	0	0
DI15	A1	0	1	0	1
DI15	A1	0	1	0	1
DI15	A1	0	1	0.5	1.5
DI15	A1	0	1	0.5	1.5
DI15	A1	0	1	0.5	1.5
DI15	A1	0	1	0	1
DI15	A1	0	1	0	1
DI15	A1	0	1	0.5	1.5
DI15	A1	0	1	0	1
DI15	A1	0	0	0	0
MA22	A1	0	1	0.5	1.5
MA22	A1	0	0	0	0
MA22	A1	0	1	0.5	1.5
MA22	A1	0	1	0.5	1.5
MA22	A1	0	1	0.5	1.5
MA22	A1	0	1	0.5	1.5
MA22	A1	0	1	0.5	1.5
MA22	A1	0	1	0.5	1.5
GI17	A1	0	1	0.5	1.5
GI17	A1	1	1	0.5	2.5
GI17	A1	0	1	0.5	1.5
GI17	A1	0	1	0	1
GI17	A1	0	1	0.5	1.5
GI17	A1	0	1	0.5	1.5
GI17	A1	0	1	0.5	1.5
AM05	A1	0	1	0	1
AM05	A1	0	1	0	1
AM05	A1	0	0	0	0
AM05	A1	0	1	0	1
AM05	A1	0	1	0	1
AM05	A1	0	0	0	0
AM05	A1	0	1	0.5	1.5
AM05	A1	0	0	0	0
LI04	A1	0	0	0	0
LI04	A1	0	1	0	1
LI04	A1	0	0	0	0
LI04	A1	0	1	0	1
LI04	A1	0	0	0	0
LI04	A1	0	0	0	0
LI04	A1	0	1	0.5	1.5
LI04	A1	0	1	0.5	1.5
LI04	A1	0	1	0.5	1.5
LI04	A1	0	1	0	1
LI04	A1	0	1	0	1
LI04	A1	0	0	0	0
LI04	A1	0	0	0	0

RE08	A1	0	1	0	1
RE08	A1	0	1	0	1
RE08	A1	0	1	0	1
RE08	A1	0	0	0	0
RE08	A1	0	1	0	1
RE08	A1	0	1	0	1
RE08	A1	0	1	0	1
RE08	A1	0	1	0	1
RE08	A1	0	1	0	1
GE08	A1	1	1	0.5	2.5
GE08	A1	1	1	0.5	2.5
GE08	A1	1	1	0.5	2.5
GE08	A1	1	1	0.5	2.5
GE08	A1	1	1	0.5	2.5
GE08	A1	1	1	0.5	2.5
GE08	A1	1	1	0.5	2.5
GE08	A1	1	1	0	2
GE08	A1	1	1	0.5	2.5
MA15	A1	0	0	0	0
MA15	A1	0	0	0	0
MA15	A1	0	0	0	0
MA15	A1	0	0	0	0
MA15	A1	0	1	0	1
MA15	A1	0	1	0	1
MA15	A1	0	1	0	1
MA15	A1	0	1	0	1
MA15	A1	0	1	0	1
MA15	A1	1	1	0.5	2.5
MA15	A1	0	0	0	0
CH05	A1	1	1	0.5	2.5
CH05	A1	0	1	0.5	1.5
CH05	A1	0	1	0.5	1.5
CH05	A1	0	1	0.5	1.5
CH05	A1	0	1	0.5	1.5
CH05	A1	0	1	0.5	1.5
CH05	A1	0	1	0.5	1.5
CH05	A1	0	1	0.5	1.5
VI20	A1	0	1	0.5	1.5
VI20	A1	0	1	0.5	1.5
VI20	A1	0	1	0.5	1.5
VI20	A1	0	1	0.5	1.5
VI20	A1	0	1	0.5	1.5
VI20	A1	0	1	0	1
VI20	A1	0	1	0	1
CH06	A1	0	1	0	1
CH06	A1	0	1	0	1
CH06	A1	0	1	0.5	1.5
CH06	A1	0	1	0.5	1.5
CH06	A1	0	1	0	1
CH06	A1	0	0	0	0
CH06	A1	0	0	0	0
JU22	A1	0	1	0.5	1.5
JU22	A1	0	1	0.5	1.5
JU22	A1	0	1	0.5	1.5
JU22	A1	0	1	0.5	1.5
JU22	A1	0	1	0.5	1.5
JU22	A1	0	1	0.5	1.5
JU22	A1	0	1	0.5	1.5
JU22	A1	0	1	0.5	1.5
JU22	A1	0	1	0.5	1.5
JU22	A1	0	1	0	1
JU22	A1	0	1	0.5	1.5
JU22	A1	0	1	0	1
JU22	A1	0	1	0	1
JU22	A1	0	0	0	0

JU22	A1	0	0	0	0
JU22	A1	0	1	0.5	1.5
JU22	A1	0	1	0.5	1.5
JU22	A1	0	0	0	0
JU22	A1	0	0	0	0
ME12	A1	0	1	0.5	1.5
ME12	A1	0	1	0.5	1.5
ME12	A1	0	1	0.5	1.5
ME12	A1	0	1	0.5	1.5
ME12	A1	0	1	0.5	1.5
ME12	A1	1	1	0.5	2.5
ME12	A1	1	1	0	2
CH09	A1	1	1	0.5	2.5
CH09	A1	1	1	0.5	2.5
CH09	A1	1	1	0.5	2.5
CH09	A1	1	1	0.5	2.5
CH09	A1	1	1	0.5	2.5
CH09	A1	1	1	0.5	2.5
CH09	A1	1	1	0.5	2.5
CH09	A1	1	1	0.5	2.5
CH09	A1	1	1	0.5	2.5
CH09	A1	1	1	0.5	2.5
CH09	A1	1	1	0.5	2.5
CH09	A1	1	1	0.5	2.5
CH09	A1	1	1	0.5	2.5
KI12	A1	0	1	0.5	1.5
KI12	A1	0	1	0	1
KI12	A1	0	1	0.5	1.5
KI12	A1	0	1	0.5	1.5
KI12	A1	0	1	0.5	1.5
KI12	A1	0	1	0.5	1.5
KI12	A1	0	1	0.5	1.5
KI12	A1	0	1	0.5	1.5
KI12	A1	0	1	0.5	1.5
KI12	A1	0	0	0	0
KI12	A1	0	0	0	0
DE15	A1	0	0	0	0
DE15	A1	0	0	0	0
DE15	A1	0	0	0	0
DE15	A1	0	1	0	1
DE15	A1	0	0	0	0
DE15	A1	0	0	0	0
DE15	A1	0	1	0.5	1.5
DE15	A1	0	1	0.5	1.5
DE15	A1	1	1	0	2
LI04b	A1	0	1	0.5	1.5
LI04b	A1	0	1	0.5	1.5
LI04b	A1	0	1	0.5	1.5
LI04b	A1	0	1	0.5	1.5
LI04b	A1	1	1	0.5	2.5
LI04b	A1	0	1	0.5	1.5
LI04b	A1	0	1	0.5	1.5
LI04b	A1	0	1	0.5	1.5
LI04b	A1	0	1	0.5	1.5
LI04b	A1	0	1	0.5	1.5
LI04b	A1	0	1	0.5	1.5
LI04b	A1	0	1	0.5	1.5
LI04b	A1	0	1	0.5	1.5
LI04b	A1	0	1	0.5	1.5
LI04b	A1	0	1	0.5	1.5
LI04b	A1	0	1	0.5	1.5
LI04b	A1	0	1	0.5	1.5
JO24	A1	1	1	0	2
JO24	A1	0	1	0	1
JO24	A1	0	1	0	1

JO24	A1	0	1	0	1
JO24	A1	0	1	0	1
JO24	A1	1	1	0	2
AN18	A1	0	1	0.5	1.5
AN18	A1	0	1	0.5	1.5
AN18	A1	0	1	0.5	1.5
AN18	A1	0	1	0.5	1.5
AN18	A1	0	1	0.5	1.5
AN18	A1	0	1	0.5	1.5
AN18	A1	0	1	0.5	1.5
ME25	A1	0	1	0	1
ME25	A1	0	0	0	0
ME25	A1	0	1	0	1
ME25	A1	1	0	0	1
ME25	A1	0	1	0.5	1.5
ME25	A1	0	1	0.5	1.5
ME25	A1	0	1	0.5	1.5
ME25	A1	1	1	0	2
ME25	A1	1	1	0	2
ME25	A1	0	1	0	1
ME25	A1	0	0	0	0
ME25	A1	0	1	0	1
ME25	A1	0	1	0.5	1.5
ME25	A1	0	1	0.5	1.5
VI01	A1	0	1	0	1
VI01	A1	0	1	0	1
VI01	A1	0	1	0.5	1.5
VI01	A1	0	1	0	1
VI01	A1	0	1	0	1
VI01	A1	0	1	0	1
VI01	A1	1	1	0.5	2.5
MA12	A1	0	1	0	1
MA12	A1	0	0	0	0
MA12	A1	0	1	0	1
MA12	A1	0	1	0	1
MA12	A1	0	0	0	0
MA12	A1	0	0	0	0
MA12	A1	0	0	0	0
MA12	A1	0	0	0	0
MA12	A1	0	0	0	0
MA12	A1	0	0	0	0
MA12	A1	0	1	0	1
MA12	A1	0	0	0	0
MA12	A1	0	1	0	1
MA12	A1	0	1	0	1
KA02b	A1	0	0	0	0
KA02b	A1	0	0	0	0
KA02b	A1	0	0	0	0
KA02b	A1	0	1	0	1
KA02b	A1	0	1	0	1
KA02b	A1	1	0	0	1
KA02b	A1	0	1	0	1
SA04b	A1	0	1	0.5	1.5
SA04b	A1	0	1	0.5	1.5
SA04b	A1	0	1	0.5	1.5
SA04b	A1	0	1	0.5	1.5
SA04b	A1	0	1	0.5	1.5
SA04b	A1	0	1	0.5	1.5
SA04b	A1	0	1	0.5	1.5
SA04b	A1	0	1	0.5	1.5
SA04b	A1	0	1	0.5	1.5
SA04b	A1	1	1	0.5	2.5
SA04b	A1	0	1	0.5	1.5
SA04b	A1	0	1	0.5	1.5
SA04b	A1	0	1	0.5	1.5

SA04b	A1	0	1	0.5	1.5
SA04b	A1	0	1	0.5	1.5
JA04	A1	0	1	0.5	1.5
JA04	A1	0	1	0.5	1.5
JA04	A1	0	1	0.5	1.5
JA04	A1	0	1	0.5	1.5
JA04	A1	0	1	0.5	1.5
JA04	A1	0	1	0.5	1.5
JA04	A1	0	1	0.5	1.5
JA04	A1	0	1	0.5	1.5
JA04	A1	0	1	0.5	1.5
JA04	A1	0	1	0.5	1.5
JA04	A1	0	1	0.5	1.5
JA04	A1	0	1	0.5	1.5
JA04	A1	0	1	0.5	1.5
SU08	B2	0	1	0.5	1.5
SU08	B2	0	1	0.5	1.5
SU08	B2	0	1	0.5	1.5
SU08	B2	0	1	0.5	1.5
SU08	B2	0	1	0.5	1.5
SU08	B2	0	1	0.5	1.5
SU08	B2	0	1	0.5	1.5
SU08	B2	0	1	0.5	1.5
SU08	B2	0	1	0.5	1.5
SU08	B2	0	1	0.5	1.5
SU08	B2	0	1	0.5	1.5
MA11a	B2	0	1	0.5	1.5
MA11a	B2	0	1	0.5	1.5
MA11a	B2	0	1	0.5	1.5
MA11a	B2	0	1	0.5	1.5
MA11a	B2	0	1	0.5	1.5
MA11a	B2	1	1	0	2
MA11a	B2	0	1	0.5	1.5
MA11a	B2	0	1	0.5	1.5
MA11a	B2	0	1	0.5	1.5
MA11a	B2	0	1	0.5	1.5
MA11a	B2	0	1	0.5	1.5
MA11a	B2	0	1	0.5	1.5
SH21	B2	0	0	0	0
SH21	B2	0	0	0	0
SH21	B2	0	1	0	1
SH21	B2	1	1	0.5	2.5
SH21	B2	0	1	0.5	1.5
SH21	B2	0	1	0	1
SH21	B2	0	0	0	0
SH21	B2	0	1	0	1
SH21	B2	0	1	0.5	1.5
SH21	B2	0	1	0.5	1.5
SH21	B2	0	0	0	0
SH21	B2	1	1	0	2
SH21	B2	0	1	0	1
AL14	B2	0	1	0.5	1.5
AL14	B2	0	1	0.5	1.5
AL14	B2	0	1	0.5	1.5
AL14	B2	0	1	0.5	1.5
AL14	B2	0	1	0.5	1.5
AL14	B2	0	1	0.5	1.5
AL14	B2	0	1	0.5	1.5
AL14	B2	1	1	0	2
AL14	B2	0	1	0.5	1.5
AL14	B2	0	1	0.5	1.5
AL14	B2	0	1	0.5	1.5
AL14	B2	0	1	0.5	1.5
AL14	B2	0	1	0.5	1.5
AL14	B2	0	1	0.5	1.5

KR20	B2	1	1	0.5	2.5
KR20	B2	1	1	0.5	2.5
KR20	B2	0	1	0.5	1.5
KR20	B2	0	1	0.5	1.5
KR20	B2	0	1	0.5	1.5
KR20	B2	0	1	0.5	1.5
KR20	B2	0	1	0.5	1.5
KR20	B2	0	1	0.5	1.5
KR20	B2	0	1	0.5	1.5
KR20	B2	0	0	0	0
KR20	B2	1	1	0.5	2.5
KR20	B2	0	1	0.5	1.5
KR20	B2	0	1	0.5	1.5
MI18	B2	0	0	0	0
MI18	B2	0	0	0	0
MI18	B2	0	0	0	0
MI18	B2	1	1	0.5	2.5
MI18	B2	1	1	0	2
MI18	B2	1	1	0	2
MI18	B2	0	1	0	1
MI18	B2	0	1	0	1
MI18	B2	0	1	0	1
MI18	B2	0	0	0	0
MI18	B2	0	1	0	1
MI18	B2	0	1	0	1
MI18	B2	0	0	0	0
MI18	B2	0	0	0	0
MI18	B2	0	1	0	1
MI18	B2	0	0	0	0
MI18	B2	0	1	0	1
MI18	B2	0	1	0	1
KA10	B2	1	1	0.5	2.5
KA10	B2	1	1	0.5	2.5
KA10	B2	1	1	0	2
KA10	B2	0	1	0.5	1.5
KA10	B2	0	1	0.5	1.5
KA10	B2	0	1	0.5	1.5
KA10	B2	0	1	0.5	1.5
KA10	B2	0	1	0.5	1.5
KA10	B2	0	1	0.5	1.5
KA10	B2	0	1	0.5	1.5
KA10	B2	0	1	0.5	1.5
KA10	B2	0	1	0.5	1.5
KA10	B2	0	1	0.5	1.5
KA10	B2	0	1	0.5	1.5
KA10	B2	0	1	0.5	1.5
KA10	B2	0	1	0.5	1.5
KA10	B2	0	1	0.5	1.5
MA11b	B2	0	1	0.5	1.5
MA11b	B2	0	1	0	1
MA11b	B2	0	1	0.5	1.5
MA11b	B2	0	1	0	1
MA11b	B2	0	1	0.5	1.5
MA11b	B2	1	1	0	2
MA11b	B2	1	1	0	2
MA11b	B2	0	1	0.5	1.5
MA11b	B2	0	0	0	0
MA11b	B2	0	0	0	0
MA11b	B2	0	1	0	1
MA11b	B2	0	1	0	1
MA11b	B2	1	1	0.5	2.5
MA11b	B2	1	1	0.5	2.5
MA11b	B2	1	1	0.5	2.5
MA11b	B2	0	1	0.5	1.5
MA11b	B2	0	1	0	1

MA11b	B2	0	0	0	0
MA11b	B2	0	1	0.5	1.5
MA11b	B2	0	0	0	0
ME11	B2	1	1	0.5	2.5
ME11	B2	1	1	0.5	2.5
ME11	B2	1	1	0.5	2.5
ME11	B2	1	1	0.5	2.5
ME11	B2	1	1	0.5	2.5
WE31	B2	1	1	0.5	2.5
WE31	B2	1	1	0.5	2.5
WE31	B2	1	1	0.5	2.5
WE31	B2	1	1	0.5	2.5
WE31	B2	1	1	0.5	2.5
WE31	B2	1	1	0.5	2.5
WE31	B2	1	1	0.5	2.5
WE31	B2	1	1	0.5	2.5
WE31	B2	1	1	0	2
WE31	B2	1	1	0.5	2.5
BE02	B2	0	1	0.5	1.5
BE02	B2	0	0	0	0
BE02	B2	0	1	0	1
BE02	B2	0	1	0.5	1.5
BE02	B2	0	1	0	1
BE02	B2	0	1	0	1
BE02	B2	0	1	0.5	1.5
BE02	B2	0	0	0	0
LA04	B2	0	0	0	0
LA04	B2	0	0	0	0
LA04	B2	0	1	0	1
LA04	B2	0	1	0	1
LA04	B2	0	1	0	1
LA04	B2	0	1	0.5	1.5
LA04	B2	0	1	0.5	1.5
LA04	B2	0	1	0.5	1.5
LA04	B2	0	1	0.5	1.5
LA04	B2	1	1	0.5	2.5
LA04	B2	0	0	0	0
LA04	B2	0	0	0	0
LA04	B2	0	0	0	0
LA04	B2	0	1	0	1
LA04	B2	0	0	0	0
LA04	B2	0	0	0	0
LA04	B2	0	0	0	0
LA04	B2	0	1	0	1
MI02	B2	0	1	0	1
MI02	B2	0	0	0	0
MI02	B2	0	0	0	0
MI02	B2	0	0	0	0
MI02	B2	0	0	0	0
MI02	B2	0	0	0	0
MI02	B2	0	0	0	0
MI02	B2	0	0	0	0
MI02	B2	0	0	0	0
MI02	B2	0	0	0	0
MI02	B2	0	0	0	0
MI02	B2	0	0	0	0
MI02	B2	0	0	0	0
MI02	B2	0	1	0	1
MI02	B2	0	1	0	1
MI02	B2	0	0	0	0
MI02	B2	0	0	0	0
PA27	B2	0	0	0	0
PA27	B2	0	1	0	1
PA27	B2	0	1	0	1
PA27	B2	0	0	0	0

PA27	B2	0	1	0	1
PA27	B2	0	0	0	0
PA27	B2	0	1	0	1
PA27	B2	0	1	0	1
PA27	B2	0	1	0	1
NA21	B2	0	1	0.5	1.5
NA21	B2	1	1	0	2
NA21	B2	1	1	0.5	2.5
NA21	B3	1	1	0	2
NA21	B2	1	1	0.5	2.5
NA21	B2	1	1	0.5	2.5
NA21	B2	1	1	0.5	2.5
NA21	B2	1	1	0.5	2.5
NA21	B2	1	1	0.5	2.5
NA21	B2	1	1	0.5	2.5
NA21	B2	1	1	0.5	2.5
MI29	B2	0	1	0.5	1.5
MI29	B2	0	1	0.5	1.5
MI29	B2	0	1	0.5	1.5
MI29	B2	0	1	0.5	1.5
MI29	B2	0	1	0.5	1.5
MI29	B2	0	1	0.5	1.5
MI29	B2	0	1	0.5	1.5
MI29	B2	0	0	0.5	0.5
MI29	B2	0	1	0	1
MI29	B2	0	1	0.5	1.5
MI29	B2	0	1	0	1
ML02	B2	0	0	0	0
ML02	B2	0	1	0	1
ML02	B2	0	1	0	1
ML02	B2	0	1	0	1
ML02	B2	0	1	0	1
ML02	B2	0	1	0	1
ML02	B2	0	1	0.5	1.5
ML02	B2	0	1	0.5	1.5
ML02	B2	0	1	0.5	1.5
DA02	B2	0	1	0.5	1.5
DA02	B2	0	1	0.5	1.5
DA02	B2	0	1	0.5	1.5
DA02	B2	0	1	0.5	1.5
DA02	B2	0	1	0.5	1.5
DA02	B2	1	1	0	2
DA02	B2	0	1	0.5	1.5
DA02	B2	0	0	0	0
DA02	B2	0	1	0	1
DA02	B2	0	1	0.5	1.5
DA02	B2	0	1	0.5	1.5
KI01	B2	0	1	0	1
KI01	B2	0	0	0	0
KI01	B2	0	1	0	1
KI01	B2	0	0	0	0
KI01	B2	0	0	0	0
KI01	B2	0	1	0	1
KI01	B2	0	1	0	1
KI01	B2	1	1	0	2
KI01	B2	0	1	0.5	1.5
KI01	B2	0	0	0	0
KI01	B2	0	0	0	0
KI01	B2	0	0	0	0
KI01	B2	0	1	0	1
KI01	B2	0	1	0	1
KI01	B2	0	0	0	0
LI11	B2	0	1	0	1
LI11	B2	0	0	0	0
LI11	B2	0	0	0	0

LI11	B2	0	1	0.5	1.5
LI11	B2	0	0	0	0
LI11	B2	0	1	0	1
LI11	B2	0	0	0	0
LI11	B2	0	1	0	1
LI11	B2	0	1	0.5	1.5
LI11	B2	0	1	0.5	1.5
LI11	B2	0	1	0.5	1.5
LI11	B2	0	0	0	0
LI11	B2	0	0	0	0
LI11	B2	0	1	0.5	1.5
LI11	B2	0	1	0	1
JA12	B2	0	0	0	0
JA12	B2	0	1	0	1
JA12	B2	0	0	0	0
JA12	B2	0	0	0	0
JA12	B2	0	1	0	1
JA12	B2	0	1	0	1
JA12	B2	0	1	0	1
JA12	B2	0	1	0	1
JA12	B2	0	1	0.5	1.5
LA11	B2	1	1	0.5	2.5
LA11	B2	1	1	0.5	2.5
LA11	B2	1	1	0.5	2.5
LA11	B2	1	1	0.5	2.5
LA11	B2	1	1	0.5	2.5
LA11	B2	0	1	0.5	1.5
LA11	B2	1	1	0.5	2.5
LA11	B2	1	1	0.5	2.5
LA11	B2	0	1	0.5	1.5
LA11	B2	0	1	0.5	1.5
LA11	B2	0	0	0	0
LA11	B2	0	1	0.5	1.5
LA11	B2	0	0	0	0
LA11	B2	0	1	0.5	1.5
LA11	B2	1	1	0.5	2.5
LE08	B2	0	0	0	0
LE08	B2	0	1	0.5	1.5
LE08	B2	0	1	0.5	1.5
LE08	B2	0	1	0.5	1.5
LE08	B2	0	1	0.5	1.5
LE08	B2	1	1	0.5	2.5
LE08	B2	0	1	0.5	1.5
LE08	B2	0	1	0.5	1.5
LE08	B2	0	1	0.5	1.5
LE08	B2	0	1	0.5	1.5
LE08	B2	0	1	0.5	1.5
LE08	B2	0	1	0.5	1.5
LE08	B2	0	1	0.5	1.5
LE08	B2	0	1	0.5	1.5
LE08	B2	0	1	0.5	1.5
LE08	B2	0	1	0.5	1.5
LE08	B2	0	1	0.5	1.5
LE08	B2	0	1	0.5	1.5
LE08	B2	0	1	0.5	1.5
LE08	B2	0	1	0.5	1.5
CH01	B2	0	0	0.5	0.5
CH01	B2	0	1	0.5	1.5
CH01	B2	0	1	0.5	1.5
CH01	B2	0	1	0.5	1.5
CH01	B2	0	1	0.5	1.5
CH01	B2	0	1	0.5	1.5
CH01	B2	0	1	0.5	1.5
CH01	B2	0	1	0.5	1.5
CH01	B2	0	1	0.5	1.5

CH01	B2	0	1	0.5	1.5
CH01	B2	0	1	0.5	1.5
CH01	B2	0	1	0.5	1.5
KA02	B2	0	1	0.5	1.5
KA02	B2	1	1	0.5	2.5
KA02	B2	0	0	0	0
KA02	B2	0	1	0.5	1.5
KA02	B2	1	1	0.5	2.5
KA02	B2	1	1	0.5	2.5
KA02	B2	1	1	0.5	2.5
KA02	B2	1	1	0.5	2.5
KA02	B2	1	1	0.5	2.5
KA02	B2	1	1	0.5	2.5
KA02	B2	1	1	0.5	2.5
KA02	B2	1	1	0.5	2.5
KA02	B2	1	1	0.5	2.5
KA02	B2	1	1	0.5	2.5
KA02	B2	1	1	0.5	2.5
SH16	B2	0	1	0.5	1.5
SH16	B2	0	1	0.5	1.5
SH16	B2	0	1	0.5	1.5
SH16	B2	0	1	0.5	1.5
SH16	B2	0	1	0.5	1.5
SH16	B2	0	1	0.5	1.5
SH16	B2	0	1	0.5	1.5
SH16	B2	0	1	0.5	1.5
SH16	B2	0	1	0.5	1.5
SH16	B2	0	1	0.5	1.5
SH16	B2	0	1	0.5	1.5
SH16	B2	0	1	0.5	1.5
SH16	B2	0	1	0.5	1.5
SH16	B2	0	1	0.5	1.5
SH16	B2	0	1	0.5	1.5
BA25	B2	0	1	0	1
BA25	B2	0	1	0	1
BA25	B2	0	1	0.5	1.5
BA25	B2	0	1	0	1
BA25	B2	0	1	0.5	1.5
BA25	B2	0	1	0	1
BA25	B2	0	1	0.5	1.5
BA25	B2	0	1	0	1
BA25	B2	0	0	0	0
BA25	B2	0	0	0	0
BA25	B2	0	1	0.5	1.5
BA25	B2	0	1	0	1
BA25	B2	0	1	0	1
BA25	B2	0	0	0	0
JE11	B2	0	1	0.5	1.5
JE11	B2	0	1	0.5	1.5
JE11	B2	0	1	0.5	1.5
JE11	B2	0	1	0.5	1.5
JE11	B2	0	1	0.5	1.5
JE11	B2	0	1	0.5	1.5
JE11	B2	0	1	0.5	1.5
JE11	B2	0	1	0.5	1.5
JE11	B2	0	1	0.5	1.5
JE11	B2	0	1	0.5	1.5
JE11	B2	0	1	0.5	1.5
JE11	B2	0	1	0.5	1.5
JE11	B2	0	1	0.5	1.5
JE11	B2	0	1	0.5	1.5
JE11	B2	0	1	0.5	1.5
JE11	B2	0	1	0.5	1.5
JE11	B2	0	1	0.5	1.5
MI29a	B2	0	1	0.5	1.5

MI29a	B2	0	1	0	1
MI29a	B2	0	1	0.5	1.5
MI29a	B2	0	1	0	1
MI29a	B2	0	1	0.5	1.5
MI29a	B2	0	1	0.5	1.5
MI29a	B2	0	1	0.5	1.5
MI29a	B2	0	1	0.5	1.5
MI29a	B2	1	1	0	2
MI29a	B2	0	0	0	0
MI29a	B2	0	0	0	0
MI29a	B2	0	1	0.5	1.5
MI29a	B2	0	1	0.5	1.5
MI29a	B2	1	1	0.5	2.5
MI29a	B2	0	0	0	0
MI29a	B2	0	1	0.5	1.5
MI29a	B2	0	1	0.5	1.5
MI29b	B2	0	1	0.5	1.5
MI29b	B2	0	1	0.5	1.5
MI29b	B2	0	1	0.5	1.5
MI29b	B2	0	1	0.5	1.5
MI29b	B2	0	1	0.5	1.5
MI29b	B2	0	1	0.5	1.5
MI29b	B2	0	1	0.5	1.5
MI29b	B2	0	1	0.5	1.5
MI29b	B2	0	1	0.5	1.5
MI29b	B2	0	1	0.5	1.5
MI29b	B2	0	1	0.5	1.5
MI29b	B2	0	1	0.5	1.5
MI29b	B2	0	1	0.5	1.5
MI29b	B2	0	1	0.5	1.5
MI29b	B2	0	1	0.5	1.5
MI29b	B2	1	1	0.5	2.5
MI29b	B2	1	1	0.5	2.5
LA03	B2	0	0	0	0
LA03	B2	0	0	0	0
LA03	B2	0	0	0	0
LA03	B2	0	1	0	1
LA03	B2	0	1	0.5	1.5
LA03	B2	0	0	0	0
LA03	B2	0	0	0	0
LA03	B2	1	1	0.5	2.5
LA03	B2	0	0	0	0
LA03	B2	0	1	0.5	1.5
LA03	B2	0	1	0.5	1.5
LA03	B2	0	1	0.5	1.5
LA03	B2	0	1	0.5	1.5
LA03	B2	0	1	0.5	1.5
LA03	B2	0	1	0.5	1.5
SO05	B2	0	1	0	1
SO05	B2	0	1	0	1
SO05	B2	0	1	0.5	1.5
SO05	B2	0	1	0	1
SO05	B2	0	0	0	0
SO05	B2	0	0	0	0
SO05	B2	0	0	0	0
SO05	B2	0	1	0	1
SO05	B2	0	1	0	1
SO05	B2	0	1	0	1
KU92	B2	1	1	0.5	2.5
KU92	B2	1	1	0.5	2.5
KU92	B2	1	1	0.5	2.5
KU92	B2	1	1	0.5	2.5
KU92	B2	1	1	0.5	2.5
KU92	B2	1	1	0.5	2.5
KU92	B2	1	1	0.5	2.5

KU92	B2	1	1	0.5	2.5
KU92	B2	1	1	0.5	2.5
KU92	B2	1	1	0.5	2.5
KU92	B2	1	1	0.5	2.5
KU92	B2	1	1	0.5	2.5
KU92	B2	1	1	0.5	2.5
KU92	B2	0	1	0.5	1.5
KU92	B2	1	1	0.5	2.5
KU92	B2	1	1	0.5	2.5
KU92	B2	1	1	0.5	2.5
KU92	B2	1	1	0.5	2.5
LA22	B2	1	0	0	1
LA22	B2	0	1	0.5	1.5
LA22	B2	0	1	0.5	1.5
LA22	B2	0	1	0.5	1.5
LA22	B2	0	0	0	0
LA22	B2	0	0	0	0
LA22	B2	0	0	0	0
LA22	B2	0	0	0	0
LA22	B2	0	0	0	0
LA22	B2	0	0	0	0
LA22	B2	0	0	0	0
LA22	B2	0	1	0.5	1.5
LA22	B2	0	0	0	0
LA22	B2	0	0	0	0
LA22	B2	0	1	0	1
SA04	B2	0	0	0	0
SA04	B2	0	1	0.5	1.5
SA04	B2	0	1	0.5	1.5
SA04	B2	0	0	0	0
SA04	B2	0	0	0	0
SA04	B2	0	0	0	0
SA04	B2	0	1	0	1
SA04	B2	0	1	0	1
SA04	B2	0	1	0	1
SA04	B2	0	1	0	1
SA04	B2	0	1	0	1
SA04	B2	0	0	0	0
SA04	B2	0	1	0	1
RE05	B2	0	1	0.5	1.5
RE05	B2	0	1	0.5	1.5
RE05	B2	0	1	0.5	1.5
RE05	B2	0	1	0.5	1.5
RE05	B2	0	1	0.5	1.5
RE05	B2	0	1	0.5	1.5
RE05	B2	0	1	0.5	1.5
RE05	B2	0	1	0.5	1.5
RE05	B2	0	1	0.5	1.5
RE05	B2	1	1	0.5	2.5
MA08	B2	0	1	0.5	1.5
MA08	B2	0	1	0.5	1.5
MA08	B2	0	1	0.5	1.5
MA08	B2	0	1	0.5	1.5
MA08	B2	0	1	0.5	1.5
MA08	B2	0	1	0.5	1.5
MA08	B2	0	1	0.5	1.5
MA08	B2	0	1	0.5	1.5
MA08	B2	0	1	0.5	1.5
SU14	B2	0	0	0	0
SU14	B2	0	1	0	1
SU14	B2	0	1	0	1
SU14	B2	0	0	0	0
SU14	B2	0	0	0	0
SU14	B2	0	0	0	0
SU14	B2	0	1	0.5	1.5

SU14	B2	1	1	0.5	2.5
SU14	B2	0	1	0.5	1.5
SU14	B2	0	1	0.5	1.5
SU14	B2	0	1	0.5	1.5
SU14	B2	0	1	0	1
SU14	B2	0	1	0	1
SU14	B2	0	0	0	0
SU14	B2	0	1	0.5	1.5
SU14	B2	0	1	0	1
SU14	B2	0	1	0	1
SU14	B2	0	1	0	1
SU11B	B2	0	1	0.5	1.5
SU11B	B2	0	1	0	1
SU11B	B2	0	0	0	0
SU11B	B2	0	0	0	0
SU11B	B2	0	0	0	0
SU11B	B2	0	0	0	0
SU11B	B2	0	1	0	1
SU11B	B2	0	1	0	1
SU11B	B2	0	1	0	1
SU11B	B2	0	1	0	1
SU11B	B2	0	1	0	1
SU11B	B2	0	1	0.5	1.5
SU11B	B2	0	1	0	1
SU11B	B2	0	0	0	0
SU11B	B2	0	1	0.5	1.5
SU11B	B2	0	0	0	0
SU11B	B2	0	1	0	1
TE27	B2	0	1	0.5	1.5
TE27	B2	0	1	0.5	1.5
TE27	B2	0	1	0.5	1.5
TE27	B2	0	1	0.5	1.5
TE27	B2	0	1	0.5	1.5
TE27	B2	0	1	0.5	1.5
TE27	B2	0	1	0.5	1.5
TE27	B2	0	1	0.5	1.5
TE27	B2	0	1	0.5	1.5
TE27	B2	0	1	0.5	1.5
TE27	B2	0	1	0.5	1.5
TE27	B2	0	1	0.5	1.5
TE27	B2	0	1	0.5	1.5
TE27	B2	0	1	0.5	1.5
TE27	B2	0	1	0.5	1.5
TE27	B2	0	1	0.5	1.5
JA04b	B2	0	0	0	0
JA04b	B2	0	1	0	1
JA04b	B2	0	1	0	1
JA04b	B2	0	1	0	1
JA04b	B2	0	0	0	0
JA04b	B2	0	1	0	1
JA04b	B2	1	1	0	2
JA04b	B2	0	0	0	0
JA04b	B2	0	0	0	0
JA04b	B2	0	1	0	1
JA04b	B2	0	0	0	0
JA04b	B2	0	0	0	0
JA04b	B2	0	0	0	0
VI10	B2	0	1	0.5	1.5
VI10	B2	0	1	0.5	1.5
VI10	B2	0	0	0	0
VI10	B2	0	1	0.5	1.5
VI10	B2	0	1	0.5	1.5
VI10	B2	0	1	0.5	1.5
VI10	B2	0	1	0.5	1.5
VI10	B2	0	1	0.5	1.5

VI10	B2	0	1	0.5	1.5
VI10	B2	0	1	0.5	1.5
VI10	B2	0	1	0.5	1.5
MI09	B2	0	1	0.5	1.5
MI09	B2	0	1	0.5	1.5
MI09	B2	0	1	0.5	1.5
MI09	B2	0	1	0.5	1.5
MI09	B2	0	1	0.5	1.5
MI09	B2	0	1	0.5	1.5
MI09	B2	0	1	0.5	1.5
MI09	B2	0	1	0.5	1.5
MI09	B2	0	1	0.5	1.5
MI09	B2	0	1	0.5	1.5
MI09	B2	0	1	0.5	1.5
MI09	B2	0	1	0.5	1.5
MI09	B2	0	1	0.5	1.5
AN24	B2	0	0	0	0
AN24	B2	0	0	0	0
AN24	B2	0	0	0	0
AN24	B2	0	0	0	0
AN24	B2	0	1	0	1
AN24	B2	0	0	0	0
AN24	B2	0	1	0	1
AN24	B2	0	0	0	0
AN24	B2	0	0	0	0
AN24	B2	0	1	0	1
AN24	B2	0	1	0	1
AN24	B2	0	0	0	0
AN24	B2	0	1	0	1
AN24	B2	0	1	0	1
AN24	B2	0	1	0	1
AN24	B2	0	1	0.5	1.5
AN24	B2	0	1	0.5	1.5
AN24	B2	0	1	0.5	1.5
DI15	B2	0	0	0	0
DI15	B2	0	1	0	1
DI15	B2	0	0	0	0
DI15	B2	0	0	0	0
DI15	B2	0	1	0.5	1.5
DI15	B2	0	1	0.5	1.5
DI15	B2	0	0	0	0
DI15	B2	0	1	0	1
DI15	B2	0	0	0	0
DI15	B2	0	1	0.5	1.5
DI15	B2	0	0	0	0
DI15	B2	0	1	0.5	1.5
DI15	B2	0	1	0.5	1.5
DI15	B2	0	1	0	1
DI15	B2	1	1	0	2
MA22	B2	0	1	0.5	1.5
MA22	B2	0	1	0.5	1.5
MA22	B2	0	1	0.5	1.5
MA22	B2	0	1	0.5	1.5
MA22	B2	0	1	0.5	1.5
MA22	B2	0	1	0.5	1.5
MA22	B2	0	0	0	0
MA22	B2	0	1	0.5	1.5
MA22	B2	0	1	0.5	1.5
MA22	B2	0	0	0	0
MA22	B2	0	1	0.5	1.5
MA22	B2	0	1	0.5	1.5
MA22	B2	0	1	0.5	1.5
GI17	B2	0	1	0.5	1.5
GI17	B2	0	1	0.5	1.5
GI17	B2	0	1	0.5	1.5

GI17	B2	0	1	0.5	1.5
GI17	B2	0	1	0.5	1.5
GI17	B2	0	0	0	0
GI17	B2	0	1	0	1
GI17	B2	0	1	0.5	1.5
AM05	B2	0	1	0	1
AM05	B2	0	0	0	0
AM05	B2	0	0	0	0
AM05	B2	0	1	0	1
AM05	B2	0	1	0	1
AM05	B2	0	1	0	1
AM05	B2	0	1	0.5	1.5
AM05	B2	0	0	0	0
AM05	B2	0	1	0	1
AM05	B2	0	1	0.5	1.5
LI04	B2	0	1	0	1
LI04	B2	0	0	0	0
LI04	B2	0	1	0	1
LI04	B2	0	1	0	1
LI04	B2	0	1	0.5	1.5
LI04	B2	0	1	0.5	1.5
LI04	B2	0	1	0.5	1.5
LI04	B2	0	1	0.5	1.5
LI04	B2	0	0	0	0
RE08	B2	0	1	0.5	1.5
RE08	B2	0	1	0.5	1.5
RE08	B2	0	1	0.5	1.5
RE08	B2	0	1	0.5	1.5
RE08	B2	0	1	0.5	1.5
RE08	B2	0	1	0.5	1.5
RE08	B2	0	1	0.5	1.5
RE08	B2	0	1	0.5	1.5
GE08	B2	1	1	0.5	2.5
GE08	B2	1	1	0.5	2.5
GE08	B2	1	1	0.5	2.5
GE08	B2	1	1	0.5	2.5
GE08	B2	1	1	0.5	2.5
GE08	B2	1	1	0.5	2.5
GE08	B2	1	1	0.5	2.5
GE08	B2	1	1	0.5	2.5
GE08	B2	1	1	0.5	2.5
GE08	B2	1	1	0.5	2.5
GE08	B2	1	1	0.5	2.5
MA15	B2	1	1	0	2
MA15	B2	1	1	0.5	2.5
MA15	B2	0	1	0.5	1.5
MA15	B2	0	0	0	0
MA15	B2	0	1	0	1
MA15	B2	0	1	0	1
MA15	B2	0	1	0.5	1.5
MA15	B2	0	0	0	0
MA15	B2	0	1	0	1
MA15	B2	0	1	0	1
MA15	B2	0	1	0	1
MA15	B2	0	1	0.5	1.5
MA15	B2	0	1	0.5	1.5
MA15	B2	0	0	0	0
CH05	B2	0	1	0.5	1.5
CH05	B2	0	1	0.5	1.5
CH05	B2	0	1	0.5	1.5
CH05	B2	0	1	0.5	1.5
CH05	B2	0	1	0.5	1.5
CH05	B2	0	1	0.5	1.5
CH05	B2	0	1	0.5	1.5
CH05	B2	0	1	0.5	1.5

CH05	B2	0	1	0.5	1.5
CH05	B2	0	1	0.5	1.5
CH05	B2	0	1	0.5	1.5
CH05	B2	0	1	0.5	1.5
CH05	B2	0	1	0.5	1.5
CH05	B2	0	1	0.5	1.5
CH05	B2	0	1	0.5	1.5
CH05	B2	0	1	0.5	1.5
CH05	B2	0	1	0.5	1.5
VI20	B2	0	1	0.5	1.5
VI20	B2	0	1	0.5	1.5
VI20	B2	0	1	0.5	1.5
VI20	B2	0	1	0.5	1.5
VI20	B2	0	0	0	0
VI20	B2	0	1	0.5	1.5
VI20	B2	0	1	0.5	1.5
VI20	B2	0	1	0.5	1.5
VI20	B2	1	1	0.5	2.5
CH06	B2	0	1	0.5	1.5
CH06	B2	1	1	0.5	2.5
CH06	B2	1	1	0.5	2.5
CH06	B2	0	1	0.5	1.5
CH06	B2	0	1	0.5	1.5
CH06	B2	0	1	0.5	1.5
CH06	B2	0	1	0	1
CH06	B2	0	1	0	1
CH06	B2	1	0	0	1
CH06	B2	1	1	0.5	2.5
CH06	B2	1	1	0.5	2.5
CH06	B2	0	1	0.5	1.5
CH06	B2	0	1	0.5	1.5
CH06	B2	0	1	0.5	1.5
CH06	B2	1	1	0.5	2.5
CH06	B2	0	1	0.5	1.5
JU22	B2	0	1	0.5	1.5
JU22	B2	0	1	0.5	1.5
JU22	B2	0	1	0.5	1.5
JU22	B2	0	1	0.5	1.5
JU22	B2	0	1	0.5	1.5
JU22	B2	0	1	0.5	1.5
JU22	B2	0	1	0.5	1.5
JU22	B2	0	1	0.5	1.5
JU22	B2	0	1	0.5	1.5
JU22	B2	0	1	0.5	1.5
JU22	B2	0	1	0.5	1.5
JU22	B2	0	1	0.5	1.5
JU22	B2	0	0	0	0
JU22	B2	0	1	0.5	1.5
JU22	B2	0	1	0	1
JU22	B2	0	1	0	1
JU22	B2	0	1	0	1
JU22	B2	0	1	0.5	1.5
JU22	B2	0	1	0.5	1.5
JU22	B2	0	0	0	0
JU22	B2	0	1	0	1
JU22	B2	0	1	0.5	1.5
ME12	B2	1	1	0.5	2.5
ME12	B2	1	1	0.5	2.5
ME12	B2	1	1	0.5	2.5
ME12	B2	1	1	0.5	2.5
ME12	B2	1	1	0.5	2.5
ME12	B2	1	1	0.5	2.5
ME12	B2	1	1	0.5	2.5
CH09	B2	1	1	0.5	2.5
CH09	B2	1	1	0.5	2.5

CH09	B2	1	1	0.5	2.5
CH09	B2	1	1	0.5	2.5
CH09	B2	1	1	0.5	2.5
CH09	B2	1	1	0.5	2.5
CH09	B2	1	1	0.5	2.5
CH09	B2	1	1	0.5	2.5
CH09	B2	1	1	0.5	2.5
CH09	B2	1	1	0.5	2.5
CH09	B2	1	1	0.5	2.5
CH09	B2	1	1	0.5	2.5
CH09	B2	1	1	0.5	2.5
CH09	B2	1	1	0.5	2.5
CH09	B2	1	1	0.5	2.5
KI12	B2	0	1	0.5	1.5
KI12	B2	0	1	0.5	1.5
KI12	B2	0	1	0.5	1.5
KI12	B2	0	1	0.5	1.5
KI12	B2	0	1	0.5	1.5
KI12	B2	0	1	0.5	1.5
KI12	B2	0	1	0.5	1.5
KI12	B2	0	1	0.5	1.5
KI12	B2	0	1	0.5	1.5
KI12	B2	0	1	0.5	1.5
KI12	B2	0	1	0.5	1.5
KI12	B2	0	1	0.5	1.5
KI12	B2	0	1	0.5	1.5
KI12	B2	0	1	0.5	1.5
KI12	B2	0	1	0.5	1.5
KI12	B2	0	0	0	0
KI12	B2	0	0	0	0
KI12	B2	1	1	0.5	2.5
KI12	B2	1	1	0.5	2.5
DE15	B2	0	1	0	1
DE15	B2	0	1	0	1
DE15	B2	0	0	0	0
DE15	B2	0	0	0	0
DE15	B2	0	0	0	0
DE15	B2	0	0	0	0
DE15	B2	0	1	0	1
DE15	B2	0	1	0	1
DE15	B2	0	1	0	1
DE15	B2	0	0	0	0
DE15	B2	0	1	0	1
DE15	B2	0	1	0	1
DE15	B2	0	1	0	1
DE15	B2	0	1	0	1
DE15	B2	0	1	0	1
DE15	B2	0	0	0	0
DE15	B2	0	1	0	1
DE15	B2	0	1	0.5	1.5
LI04b	B2	0	1	0.5	1.5
LI04b	B2	1	1	0	2
LI04b	B2	0	1	0.5	1.5
LI04b	B2	0	1	0.5	1.5
LI04b	B2	0	1	0.5	1.5
LI04b	B2	0	1	0.5	1.5
LI04b	B2	0	1	0.5	1.5
LI04b	B2	0	1	0.5	1.5
LI04b	B2	0	1	0.5	1.5
LI04b	B2	0	1	0.5	1.5
LI04b	B2	0	1	0.5	1.5
LI04b	B2	0	1	0.5	1.5
LI04b	B2	0	1	0.5	1.5
LI04b	B2	0	1	0.5	1.5
LI04b	B2	0	1	0.5	1.5

LI04b	B2	0	1	0.5	1.5
LI04b	B2	0	1	0.5	1.5
LI04b	B2	0	1	0.5	1.5
LI04b	B2	0	1	0.5	1.5
LI04b	B2	0	1	0.5	1.5
LI04b	B2	0	1	0.5	1.5
LI04b	B2	0	1	0.5	1.5
LI04b	B2	0	1	0.5	1.5
LI04b	B2	1	1	0.5	2.5
LI04b	B2	0	1	0.5	1.5
JO24	B2	0	1	0	1
JO24	B2	0	1	0.5	1.5
JO24	B2	0	0	0	0
JO24	B2	0	1	0	1
JO24	B2	0	1	0	1
JO24	B2	0	1	0.5	1.5
JO24	B2	0	1	0	1
JO24	B2	0	1	0.5	1.5
AN18	B2	0	1	0	1
AN18	B2	0	1	0	1
AN18	B2	0	1	0	1
AN18	B2	0	1	0	1
AN18	B2	0	1	0	1
AN18	B2	0	1	0	1
AN18	B2	0	1	0	1
AN18	B2	0	1	0	1
AN18	B2	0	1	0	1
AN18	B2	0	1	0	1
AN18	B2	0	1	0	1
AN18	B2	0	1	0	1
AN18	B2	0	1	0.5	1.5
AN18	B2	0	1	0.5	1.5
AN18	B2	0	1	0.5	1.5
AN18	B2	0	1	0.5	1.5
AN18	B2	0	1	0	1
AN18	B2	0	1	0.5	1.5
AN18	B2	0	1	0.5	1.5
AN18	B2	0	1	0.5	1.5
AN18	B2	0	1	0	1
AN18	B2	0	1	0	1
AN18	B2	0	1	0.5	1.5
AN18	B2	0	1	0.5	1.5
AN18	B2	0	1	0.5	1.5
AN18	B2	0	1	0.5	1.5
AN18	B2	0	1	0.5	1.5
AN18	B2	0	1	0.5	1.5
AN18	B2	0	1	0.5	1.5
AN18	B2	0	1	0.5	1.5
AN18	B2	0	1	0.5	1.5
AN18	B2	0	1	0.5	1.5
AN18	B2	0	1	0.5	1.5
ME25	B2	0	0	0	0
ME25	B2	0	0	0	0
ME25	B2	0	0	0	0
ME25	B2	1	1	0	2
ME25	B2	0	0	0	0
ME25	B2	0	1	0	1
ME25	B2	0	1	0	1
ME25	B2	1	1	0.5	2.5
ME25	B2	0	1	0	1
ME25	B2	0	1	0	1
ME25	B2	0	1	0	1
ME25	B2	0	0	0	0
ME25	B2	0	0	0	0
ME25	B2	0	1	0	1

VI01	B2	0	1	0	1
VI01	B2	0	1	0	1
VI01	B2	0	1	0	1
VI01	B2	0	1	0	1
VI01	B2	0	1	0	1
VI01	B2	0	1	0	1
VI01	B2	0	1	0	1
VI01	B2	0	1	0	1
VI01	B2	0	1	0	1
VI01	B2	0	1	0	1
VI01	B2	0	1	0	1
VI01	B2	0	1	0	1
VI01	B2	0	1	0.5	1.5
VI01	B2	0	1	0	1
VI01	B2	0	1	0	1
VI01	B2	0	1	0	1
VI01	B2	0	1	0	1
VI01	B2	0	1	0	1
MA12	B2	0	1	0	1
MA12	B2	0	0	0	0
MA12	B2	0	0	0	0
MA12	B2	0	1	0	1
MA12	B2	0	1	0	1
MA12	B2	1	1	0	2
MA12	B2	0	0	0	0
MA12	B2	0	1	0	1
MA12	B2	0	1	0	1
MA12	B2	0	1	0	1
MA12	B2	0	1	0	1
MA12	B2	0	1	0	1
MA12	B2	1	1	0	2
MA12	B2	1	1	0	2
MA12	B2	1	1	0	2
MA12	B2	1	1	0	2
MA12	B2	1	0	0	1
MA12	B2	0	1	0.5	1.5
KA02b	B2	0	1	0	1
KA02b	B2	0	0	0	0
KA02b	B2	0	0	0	0
KA02b	B2	0	1	0	1
KA02b	B2	0	0	0	0
KA02b	B2	0	1	0	1
KA02b	B2	0	0	0	0
KA02b	B2	0	1	0	1
KA02b	B2	0	0	0	0
KA02b	B2	0	0	0	0
KA02b	B2	0	0	0	0
KA02b	B2	0	0	0	0
SA04b	B2	0	1	0.5	1.5
SA04b	B2	0	1	0.5	1.5
SA04b	B2	0	1	0.5	1.5
SA04b	B2	0	1	0.5	1.5
SA04b	B2	0	1	0.5	1.5
SA04b	B2	0	1	0.5	1.5
SA04b	B2	0	1	0.5	1.5
SA04b	B2	0	1	0.5	1.5
SA04b	B2	0	1	0.5	1.5
SA04b	B2	0	1	0.5	1.5
SA04b	B2	0	1	0.5	1.5
SA04b	B2	0	1	0.5	1.5
SA04b	B2	0	1	0.5	1.5
SA04b	B2	0	1	0.5	1.5
SA04b	B2	0	1	0.5	1.5
JA04	B2	0	1	0.5	1.5
JA04	B2	0	1	0.5	1.5

JA04	B2	0	1	0.5	1.5
JA04	B2	0	1	0.5	1.5
JA04	B2	0	1	0.5	1.5
JA04	B2	0	1	0.5	1.5
JA04	B2	0	1	0.5	1.5
JA04	B2	0	1	0.5	1.5
JA04	B2	0	1	0.5	1.5
JA04	B2	0	1	0.5	1.5
JA04	B2	0	1	0.5	1.5
JA04	B2	0	1	0.5	1.5
JA04	B2	0	1	0.5	1.5
JA04	B2	0	1	0.5	1.5
JA04	B2	0	1	0.5	1.5
JA04	B2	0	1	0.5	1.5
JA04	B2	0	1	0.5	1.5
JA04	B2	0	1	0.5	1.5
JA04	B2	0	1	0.5	1.5
AN09	A2	0	1	0.5	1.5
AN09	A2	1	1	0.5	2.5
AN09	A2	0	0	0	0
AN09	A2	0	0	0	0
AN09	A2	1	1	0	2
AN09	A2	0	1	0	1
AN09	A2	1	1	0	2
AN09	A2	0	0	0	0
AN09	A2	0	0	0	0
AN09	A2	1	1	0	2
GI21	A2	0	1	0.5	1.5
GI21	A2	0	1	0.5	1.5
GI21	A2	0	1	0.5	1.5
GI21	A2	0	1	0.5	1.5
GI21	A2	0	1	0.5	1.5
GI21	A2	0	1	0.5	1.5
GI21	A2	0	1	0.5	1.5
GI21	A2	0	1	0.5	1.5
GI21	A2	0	1	0.5	1.5
GI21	A2	0	1	0.5	1.5
GI21	A2	0	0	0	0
GI21	A2	0	1	0	1
GI21	A2	0	0	0	0
GI21	A2	0	0	0	0
GI21	A2	0	1	0.5	1.5
GI21	A2	0	1	0.5	1.5
GI21	A2	0	1	0.5	1.5
GI21	A2	1	1	0	2
GI21	A2	0	1	0.5	1.5
GI21	A2	0	1	0.5	1.5
CH15	A2	0	1	0	1
CH15	A2	0	1	0	1
CH15	A2	0	1	0.5	1.5
CH15	A2	0	0	0	0
CH15	A2	0	1	0	1
CH15	A2	0	1	0	1
CH15	A2	0	0	0	0
CH15	A2	0	1	0.5	1.5
CH15	A2	1	1	0.5	2.5
CH15	A2	0	1	0.5	1.5
CH15	A2	0	1	0	1
CH15	A2	0	1	0	1
CH15	A2	0	0	0	0
CH15	A2	0	0	0	0
CH15	A2	0	1	0.5	1.5
CH15	A2	0	1	0.5	1.5
CH15	A2	1	0	0	1
CH15	A2	0	1	0	1

CH15	A2	0	1	0.5	1.5
CH15	A2	0	1	0	1
CH15	A2	0	0	0	0
CH15	A2	0	1	0	1
CH15	A2	0	0	0	0
CH15	A2	1	0	0	1
CH15	A2	0	0	0	0
CH15	A2	0	0	0	0
SU02	A2	0	1	0.5	1.5
SU02	A2	0	1	0.5	1.5
SU02	A2	0	1	0.5	1.5
SU02	A2	0	1	0.5	1.5
SU02	A2	0	1	0	1
SU02	A2	0	1	0	1
SU02	A2	0	1	0	1
SU02	A2	0	1	0	1
SU02	A2	0	0	0.5	0.5
SU02	A2	0	1	0.5	1.5
SU02	A2	0	0	0	0
SU02	A2	0	1	0	1
SU02	A2	0	1	0	1
LO01	A2	0	1	0.5	1.5
LO01	A2	0	1	0.5	1.5
LO01	A2	0	1	0.5	1.5
LO01	A2	0	1	0.5	1.5
LO01	A2	0	1	0.5	1.5
LO01	A2	0	1	0.5	1.5
LO01	A2	0	1	0.5	1.5
LO01	A2	0	1	0.5	1.5
LO01	A2	0	1	0.5	1.5
LO01	A2	0	1	0.5	1.5
LO01	A2	0	1	0.5	1.5
LO01	A2	1	1	0.5	2.5
LO01	A2	0	1	0.5	1.5
LO01	A2	0	1	0.5	1.5
LO01	A2	0	1	0.5	1.5
LO01	A2	0	1	0.5	1.5
LO01	A2	0	1	0.5	1.5
LO01	A2	0	1	0.5	1.5
LO01	A2	0	1	0.5	1.5
JU02	A2	0	1	0.5	1.5
JU02	A2	0	1	0	1
JU02	A2	0	1	0	1
JU02	A2	0	1	0.5	1.5
JU02	A2	0	1	0	1
JU02	A2	1	1	0.5	2.5
JU02	A2	0	1	0	1
JU02	A2	0	1	0	1
JU02	A2	0	1	0.5	1.5
JU02	A2	0	0	0	0
JU02	A2	0	0	0	0
JU02	A2	0	1	0.5	1.5
JU02	A2	0	1	0.5	1.5
JU02	A2	0	1	0	1
LO03	A2	1	1	0.5	2.5
LO03	A2	1	1	0.5	2.5
LO03	A2	1	1	0.5	2.5
LO03	A2	1	1	0.5	2.5
LO03	A2	1	1	0.5	2.5
LO03	A2	1	1	0.5	2.5
LO03	A2	1	1	0.5	2.5
LO03	A2	1	1	0.5	2.5
LO03	A2	1	1	0.5	2.5
LO03	A2	1	1	0.5	2.5
LO03	A2	1	1	0.5	2.5

AM20	A2	1	1	0	2
AM20	A2	1	1	0.5	2.5
AM20	A2	0	1	0	1
AM20	A2	0	1	0	1
AM20	A2	0	1	0.5	1.5
AM20	A2	0	1	0.5	1.5
AM20	A2	0	1	0.5	1.5
MA19	A2	0	0	0	0
MA19	A2	0	1	0.5	1.5
MA19	A2	0	1	0.5	1.5
MA19	A2	0	1	0	1
MA19	A2	0	0	0	0
MA19	A2	0	1	0	1
MA19	A2	0	0	0	0
MA19	A2	0	0	0	0
MA19	A2	0	0	0	0
MA19	A2	0	0	0	0
MA19	A2	0	1	0	1
MA19	A2	0	1	0	1
MA19	A2	0	0	0	0
MA19	A2	0	0	0	0
MA19	A2	0	1	0	1
MA19	A2	0	1	0	1
MA19	A2	0	1	0.5	1.5
MA19	A2	0	0	0	0
MA19	A2	0	0	0	0
MA19	A2	0	1	0.5	1.5
MA19	A2	0	0	0	0
MA19	A2	0	1	0	1
MA19	A2	0	1	0.5	1.5
MA19	A2	0	1	0	1
MA19	A2	0	1	0	1
MA19	A2	0	0	0	0
SA11	A2	0	1	0	1
SA11	A2	0	0	0	0
SA11	A2	0	1	0	1
SA11	A2	0	0	0	0
SA11	A2	0	1	0	1
SA11	A2	0	1	0	1
SA11	A2	0	1	0	1
SA11	A2	0	1	0	1
SA11	A2	0	1	0	1
SA11	A2	0	0	0	0
SA11	A2	0	1	0	1
SA11	A2	0	0	0	0
SA11	A2	0	1	0	1
SA11	A2	0	0	0	0
SA11	A2	0	1	0	1
SA11	A2	0	1	0	1
SA11	A2	1	0	0	1
SA11	A2	0	0	0	0
SA11	A2	1	0	0	1
SA11	A2	0	1	0	1
SA11	A2	0	1	0	1
JE06	A2	0	1	0	1
JE06	A2	0	0	0	0
JE06	A2	0	0	0	0
JE06	A2	0	0	0	0
JE06	A2	0	1	0	1
JE06	A2	0	1	0	1
JE06	A2	0	1	0	1
JE06	A2	0	1	0.5	1.5
JE06	A2	0	1	0.5	1.5
JE06	A2	0	1	0.5	1.5
JE06	A2	0	1	0	1

JE06	A2	0	1	0	1
JE06	A2	0	0	0	0
JE06	A2	0	0	0	0
JE06	A2	0	1	0	1
JE06	A2	0	1	0.5	1.5
JE06	A2	0	1	0.5	1.5
JE06	A2	0	1	0.5	1.5
JE06	A2	0	1	0.5	1.5
JE06	A2	0	1	0.5	1.5
JE06	A2	0	1	0.5	1.5
JE10	A2	0	1	0.5	1.5
JE10	A2	0	1	0.5	1.5
JE10	A2	0	1	0.5	1.5
JE10	A2	0	1	0.5	1.5
JE10	A2	0	1	0.5	1.5
JE10	A2	0	1	0.5	1.5
JE10	A2	0	1	0.5	1.5
JE10	A2	0	1	0.5	1.5
JE10	A2	0	1	0.5	1.5
JE10	A2	0	1	0.5	1.5
JE10	A2	0	1	0.5	1.5
JE10	A2	0	1	0.5	1.5
JE10	A2	0	1	0.5	1.5
JE10	A2	0	1	0.5	1.5
JE10	A2	0	1	0.5	1.5
JE10	A2	0	1	0.5	1.5
JE10	A2	0	1	0.5	1.5
JE10	A2	0	1	0	1
JE10	A2	0	1	0.5	1.5
JE10	A2	0	1	0.5	1.5
JE10	A2	0	1	0.5	1.5
JE10	A2	0	1	0.5	1.5
JE10	A2	0	1	0.5	1.5
TA06	A2	0	1	0	1
TA06	A2	0	0	0	0
TA06	A2	0	0	0	0
TA06	A2	0	1	0.5	1.5
TA06	A2	0	1	0.5	1.5
TA06	A2	0	1	0.5	1.5
TA06	A2	0	1	0.5	1.5
TA06	A2	0	1	0.5	1.5
TA06	A2	0	1	0.5	1.5
TA06	A2	0	1	0.5	1.5
TA06	A2	0	1	0.5	1.5
TA06	A2	0	1	0.5	1.5
TA06	A2	0	1	0.5	1.5
TA06	A2	0	1	0.5	1.5
TA06	A2	0	1	0.5	1.5
TA06	A2	0	1	0.5	1.5
TA06	A2	0	1	0.5	1.5
TA06	A2	0	1	0.5	1.5
TA06	A2	0	1	0.5	1.5
TA06	A2	0	1	0.5	1.5
TA06	A2	0	1	0.5	1.5
TA06	A2	0	1	0.5	1.5
TA06	A2	0	0	0	0
BR02	A2	1	1	0.5	2.5
BR02	A2	1	1	0.5	2.5
BR02	A2	1	1	0.5	2.5
BR02	A2	1	1	0.5	2.5
BR02	A2	1	1	0.5	2.5
AN11	A2	0	1	0.5	1.5
AN11	A2	0	0	0	0
AN11	A2	0	0	0	0
AN11	A2	0	1	0	1

AN11	A2	0	1	0.5	1.5
AN11	A2	0	0	0	0
AN11	A2	0	0	0	0
AN11	A2	0	1	0	1
AN11	A2	0	1	0	1
AN11	A2	0	1	0	1
KA05	A2	0	0	0	0
KA05	A2	0	0	0	0
KA05	A2	0	1	0.5	1.5
KA05	A2	0	1	0	1
KA05	A2	0	0	0	0
KA05	A2	0	1	0	1
KA05	A2	0	1	0	1
KA05	A2	0	1	0	1
KA05	A2	0	1	0.5	1.5
CI26	A2	0	0	0	0
CI26	A2	0	0	0	0
CI26	A2	0	0	0	0
CI26	A2	0	1	0	1
CI26	A2	0	0	0	0
CI26	A2	0	1	0	1
CI26	A2	0	1	0	1
CI26	A2	0	1	0	1
CI26	A2	0	0	0	0
CI26	A2	0	1	0	1
CI26	A2	0	1	0	1
CI26	A2	0	1	0	1
CI26	A2	0	1	0	1
CI26	A2	0	1	0	1
CI26	A2	0	0	0	0
CI26	A2	0	1	0	1
CI26	A2	0	1	0	1
LY04	A2	0	1	0.5	1.5
LY04	A2	0	1	0.5	1.5
LY04	A2	1	1	0	2
LY04	A2	1	1	0	2
LY04	A2	1	1	0	2
LY04	A2	0	1	0.5	1.5
LY04	A2	0	1	0.5	1.5
LY04	A2	0	1	0.5	1.5
LY04	A2	0	1	0.5	1.5
LY04	A2	0	1	0.5	1.5
LY04	A2	0	1	0.5	1.5
LY04	A2	0	1	0.5	1.5
LY04	A2	0	1	0.5	1.5
LY04	A2	0	1	0.5	1.5
LY04	A2	0	1	0.5	1.5
LY04	A2	0	1	0.5	1.5
JE17	A2	0	1	0.5	1.5
JE17	A2	0	1	0.5	1.5
JE17	A2	0	1	0.5	1.5
JE17	A2	0	1	0.5	1.5
JE17	A2	0	1	0.5	1.5
JE17	A2	0	1	0.5	1.5
JE17	A2	0	1	0.5	1.5
JE17	A2	0	1	0.5	1.5
JE17	A2	1	1	0.5	2.5
JE17	A2	1	1	0.5	2.5
JE17	A2	1	1	0.5	2.5
JE17	A2	1	1	0.5	2.5
JE17	A2	1	1	0.5	2.5
JE17	A2	1	1	0.5	2.5
JE17	A2	0	1	0.5	1.5
JE17	A2	0	1	0.5	1.5
SA06	A2	1	1	0	2

SA06	A2	0	1	0	1
SA06	A2	0	1	0.5	1.5
SA06	A2	0	1	0.5	1.5
SA06	A2	0	1	0.5	1.5
SA06	A2	0	1	0.5	1.5
SA06	A2	0	1	0.5	1.5
SA06	A2	0	1	0	1
SA06	A2	0	1	0.5	1.5
SA06	A2	0	1	0.5	1.5
SA06	A2	0	1	0.5	1.5
SA06	A2	0	0	0	0
SA06	A2	0	1	0	1
SA06	A2	0	1	0	1
SA06	A2	0	1	0.5	1.5
SA06	A2	0	1	0	1
SA06	A2	0	1	0.5	1.5
MA02	A2	0	1	0.5	1.5
MA02	A2	0	1	0.5	1.5
MA02	A2	0	1	0.5	1.5
MA02	A2	0	1	0.5	1.5
MA02	A2	0	1	0.5	1.5
MA02	A2	0	1	0.5	1.5
MA02	A2	0	1	0.5	1.5
MA02	A2	0	1	0.5	1.5
MA02	A2	0	1	0.5	1.5
MA02	A2	0	1	0.5	1.5
MA02	A2	0	1	0.5	1.5
MA02	A2	0	1	0	1
MA02	A2	0	1	0	1
MA02	A2	0	1	0.5	1.5
MA02	A2	0	1	0.5	1.5
MA02	A2	0	1	0.5	1.5
MA02	A2	0	1	0.5	1.5
MA02	A2	0	1	0.5	1.5
CA11	A2	0	1	0.5	1.5
CA11	A2	0	1	0.5	1.5
CA11	A2	0	1	0.5	1.5
CA11	A2	0	1	0.5	1.5
CA11	A2	0	1	0.5	1.5
CA11	A2	0	1	0.5	1.5
CA11	A2	0	1	0	1
CA11	A2	0	1	0.5	1.5
CA11	A2	0	1	0.5	1.5
CA11	A2	0	1	0.5	1.5
MA01a	A2	1	1	0.5	2.5
MA01a	A2	1	1	0.5	2.5
MA01a	A2	1	1	0.5	2.5
MA01a	A2	1	1	0.5	2.5
MA01a	A2	1	1	0.5	2.5
MA01a	A2	1	1	0.5	2.5
MA01a	A2	1	1	0.5	2.5
JO04	A2	0	1	0.5	1.5
JO04	A2	0	1	0.5	1.5
JO04	A2	0	1	0.5	1.5
JO04	A2	0	1	0.5	1.5
JO04	A2	0	1	0.5	1.5
JO04	A2	0	1	0.5	1.5
JO04	A2	0	1	0.5	1.5
JO04	A2	0	1	0.5	1.5
JO04	A2	0	1	0.5	1.5
JO04	A2	0	1	0	1
JO04	A2	1	1	0.5	2.5
JO04	A2	0	1	0.5	1.5
JO04	A2	0	1	0.5	1.5
JO04	A2	0	0	0	0

JO04	A2	0	1	0.5	1.5
JO04	A2	1	1	0.5	2.5
JO04	A2	1	1	0	2
JO04	A2	0	1	0.5	1.5
JO04	A2	0	1	0.5	1.5
JO04	A2	0	1	0	1
JO04	A2	0	1	0.5	1.5
JO04	A2	0	1	0.5	1.5
JO04	A2	0	1	0.5	1.5
JO04	A2	0	1	0.5	1.5
LA07	A2	0	1	0.5	1.5
LA07	A2	0	1	0.5	1.5
LA07	A2	0	1	0.5	1.5
LA07	A2	0	1	0.5	1.5
LA07	A2	0	1	0.5	1.5
LA07	A2	0	1	0.5	1.5
LA07	A2	0	1	0.5	1.5
LA07	A2	0	1	0.5	1.5
LA07	A2	0	1	0.5	1.5
LA07	A2	0	1	0.5	1.5
LA07	A2	1	1	0.5	2.5
LA07	A2	0	1	0.5	1.5
LA07	A2	0	1	0.5	1.5
LA07	A2	0	1	0.5	1.5
LA07	A2	0	1	0.5	1.5
LA07	A2	0	1	0.5	1.5
LA07	A2	0	1	0.5	1.5
MI16	A2	0	0	0	0
MI16	A2	0	0	0	0
MI16	A2	0	0	0	0
MI16	A2	0	1	0	1
MI16	A2	0	1	0.5	1.5
MI16	A2	0	1	0	1
MI16	A2	0	1	0	1
MI16	A2	0	1	0.5	1.5
MI16	A2	0	1	0	1
MI16	A2	0	1	0	1
MI16	A2	0	1	0	1
MI16	A2	0	1	0	1
MI16	A2	0	1	0	1
MI16	A2	0	1	0	1
MI16	A2	0	1	0	1
MI16	A2	0	1	0	1
MI16	A2	1	1	0	2
MI16	A2	0	0	0	0
CH02	A2	1	1	0.5	2.5
CH02	A2	0	1	0	1
CH02	A2	0	1	0.5	1.5
CH02	A2	1	1	0	2
CH02	A2	1	1	0	2
CH02	A2	0	1	0	1
CH02	A2	0	1	0.5	1.5
CH02	A2	0	1	0	1
CH02	A2	1	1	0.5	2.5
CH02	A2	0	1	0	1
CH02	A2	1	1	0	2
CH02	A2	0	0	0	0
LI14	A2	1	1	0	2
LI14	A2	1	1	0	2
LI14	A2	1	1	0.5	2.5
LI14	A2	0	1	0.5	1.5
LI14	A2	0	1	0.5	1.5
LI14	A2	0	1	0.5	1.5
LI14	A2	0	1	0.5	1.5
LI14	A2	0	1	0.5	1.5

LI14	A2	0	1	0.5	1.5
LI14	A2	0	1	0.5	1.5
LI14	A2	0	1	0.5	1.5
LI14	A2	0	1	0.5	1.5
LI14	A2	0	1	0.5	1.5
CH11	A2	0	1	0	1
CH11	A2	0	1	0	1
CH11	A2	0	1	0	1
CH11	A2	1	1	0	2
CH11	A2	0	1	0	1
CH11	A2	0	0	0	0
CH11	A2	0	0	0	0
CH11	A2	0	1	0	1
CH11	A2	0	1	0	1
CH11	A2	0	1	0	1
TE30	A2	0	1	0	1
TE30	A2	0	0	0	0
TE30	A2	0	1	0	1
TE30	A2	0	1	0	1
TE30	A2	0	1	0	1
TE30	A2	0	1	0	1
TE30	A2	0	1	0	1
TE30	A2	0	1	0	1
TE30	A2	0	1	0	1
TE30	A2	0	0	0	0
TE30	A2	0	1	0	1
TE30	A2	0	1	0.5	1.5
TE30	A2	0	1	0.5	1.5
MA01b	A2	0	1	0.5	1.5
MA01b	A2	0	1	0.5	1.5
MA01b	A2	0	1	0.5	1.5
MA01b	A2	0	1	0.5	1.5
MA01b	A2	0	1	0.5	1.5
MA01b	A2	0	1	0.5	1.5
MA01b	A2	0	1	0.5	1.5
MA01b	A2	0	1	0.5	1.5
MA01b	A2	0	1	0.5	1.5
MA01b	A2	0	1	0.5	1.5
MA01b	A2	0	1	0.5	1.5
MA01b	A2	0	1	0.5	1.5
BA23	A2	0	1	0.5	1.5
BA23	A2	0	1	0.5	1.5
BA23	A2	0	1	0.5	1.5
BA23	A2	0	1	0.5	1.5
BA23	A2	0	1	0.5	1.5
BA23	A2	0	1	0.5	1.5
BA23	A2	0	1	0.5	1.5
BA23	A2	0	1	0.5	1.5
BA23	A2	0	1	0.5	1.5
BA23	A2	0	1	0.5	1.5
BA23	A2	0	1	0.5	1.5
BA23	A2	0	1	0.5	1.5
BA23	A2	0	1	0.5	1.5
BA23	A2	0	1	0.5	1.5
BA23	A2	0	1	0.5	1.5
KA19	A2	0	0	0	0
KA19	A2	0	1	0	1
KA19	A2	0	0	0	0
KA19	A2	0	0	0	0
KA19	A2	0	1	0	1
KA19	A2	0	0	0	0
KA19	A2	0	0	0	0
KA19	A2	0	0	0	0
KA19	A2	0	1	0	1
KA19	A2	0	1	0	1

KA19	A2	0	1	0	1
KA19	A2	0	0	0	0
KA19	A2	0	0	0	0
KA19	A2	0	1	0	1
KA19	A2	0	1	0	1
KA19	A2	0	1	0	1
KA19	A2	0	1	0	1
KA19	A2	0	0	0	0
KA19	A2	0	0	0	0
KA19	A2	1	1	0	2
KA19	A2	1	1	0	2
KA19	A2	0	1	0	1
KA19	A2	0	0	0	0
TA18	A2	0	1	0.5	1.5
TA18	A2	0	1	0.5	1.5
TA18	A2	0	1	0.5	1.5
TA18	A2	0	1	0.5	1.5
TA18	A2	0	1	0.5	1.5
TA18	A2	0	1	0.5	1.5
TA18	A2	0	1	0.5	1.5
TA18	A2	0	1	0.5	1.5
TA18	A2	0	1	0.5	1.5
TA18	A2	0	1	0.5	1.5
TA18	A2	0	1	0.5	1.5
TA18	A2	0	1	0.5	1.5
TA18	A2	0	0	0.5	0.5
TA18	A2	0	1	0.5	1.5
DE09	A2	0	1	0.5	1.5
DE09	A2	0	1	0.5	1.5
DE09	A2	0	1	0.5	1.5
DE09	A2	0	1	0.5	1.5
DE09	A2	0	1	0.5	1.5
DE09	A2	0	1	0.5	1.5
DE09	A2	0	1	0.5	1.5
DE09	A2	0	1	0.5	1.5
DE09	A2	0	1	0.5	1.5
DE09	A2	0	1	0.5	1.5
DE09	A2	0	1	0.5	1.5
DE09	A2	0	1	0.5	1.5
KA09	A2	1	1	0.5	2.5
KA09	A2	1	1	0.5	2.5
KA09	A2	1	1	0.5	2.5
KA09	A2	1	1	0.5	2.5
KA09	A2	1	1	0.5	2.5
KA09	A2	1	1	0.5	2.5
KA09	A2	1	1	0.5	2.5
KA09	A2	1	1	0.5	2.5
KA09	A2	1	1	0.5	2.5
KA09	A2	1	0	0.5	1.5
KA09	A2	1	1	0.5	2.5
KA09	A2	1	1	0.5	2.5
KA09	A2	1	1	0.5	2.5
PE06	A2	0	1	0	1
PE06	A2	0	1	0	1
PE06	A2	0	1	0	1
PE06	A2	1	1	0	2
AS17	A2	0	1	0.5	1.5
AS17	A2	0	1	0	1
AS17	A2	0	0	0	0
AS17	A2	0	1	0	1
AS17	A2	0	1	0	1
AS17	A2	0	1	0	1
AS17	A2	0	0	0	0
AS17	A2	0	1	0	1
AS17	A2	0	0	0	0

RO02	A2	1	1	0.5	2.5
RO02	A2	1	1	0.5	2.5
RO02	A2	1	1	0.5	2.5
RO02	A2	1	1	0.5	2.5
RO02	A2	1	1	0.5	2.5
RO02	A2	1	1	0.5	2.5
RO02	A2	1	1	0.5	2.5
RO02	A2	1	1	0.5	2.5
TO09	A2	0	1	0.5	1.5
TO09	A2	0	1	0.5	1.5
TO09	A2	0	1	0	1
TO09	A2	0	1	0	1
TO09	A2	0	1	0	1
TO09	A2	0	1	0.5	1.5
TO09	A2	0	1	0	1
TO09	A2	0	1	0.5	1.5
TO09	A2	0	1	0.5	1.5
TO09	A2	0	1	0	1
TO09	A2	0	1	0	1
TO09	A2	0	0	0	0
TO09	A2	0	1	0	1
TO09	A2	0	1	0	1
TO09	A2	0	1	0.5	1.5
SO07	A2	1	1	0.5	2.5
SO07	A2	1	1	0.5	2.5
SO07	A2	0	1	0.5	1.5
SO07	A2	0	1	0.5	1.5
SO07	A2	0	1	0.5	1.5
SO07	A2	0	1	0.5	1.5
SO07	A2	1	1	0.5	2.5
SO07	A2	0	1	0.5	1.5
SO07	A2	0	1	0.5	1.5
SO07	A2	0	1	0.5	1.5
SO07	A2	0	1	0.5	1.5
SO07	A2	0	1	0	1
SO07	A2	0	1	0.5	1.5
BH15	A2	0	1	0	1
BH15	A2	0	1	0.5	1.5
BH15	A2	1	0	0	1
BH15	A2	0	1	0	1
BH15	A2	1	1	0.5	2.5
BH15	A2	0	1	0.5	1.5
BH15	A2	0	1	0.5	1.5
BH15	A2	0	1	0.5	1.5
BH15	A2	0	1	0.5	1.5
BH15	A2	0	1	0.5	1.5
BH15	A2	0	1	0.5	1.5
BH15	A2	1	1	0.5	2.5
BH15	A2	1	1	0.5	2.5
BH15	A2	0	1	0.5	1.5
BH15	A2	0	1	0.5	1.5
BH15	A2	0	1	0.5	1.5
BH15	A2	0	1	0.5	1.5
BH15	A2	0	1	0.5	1.5
BH15	A2	0	1	0.5	1.5
CA21	A2	0	0	0	0
CA21	A2	0	0	0	0
CA21	A2	0	0	0	0
CA21	A2	0	1	0.5	1.5
CA21	A2	0	0	0	0
CA21	A2	0	0	0	0
CA21	A2	0	1	0.5	1.5
CA21	A2	0	1	0.5	1.5
CA21	A2	0	1	0.5	1.5
CA21	A2	0	0	0	0

CA21	A2	0	1	0	1
CA21	A2	0	1	0	1
CA21	A2	0	0	0	0
CA21	A2	0	0	0	0
CA21	A2	0	0	0	0
CA21	A2	0	0	0	0
CA21	A2	0	0	0	0
CA21	A2	0	1	0.5	1.5
CA21	A2	0	1	0.5	1.5
CA21	A2	0	1	0.5	1.5
CA21	A2	1	1	0	2
KI10	A2	1	1	0.5	2.5
KI10	A2	1	1	0.5	2.5
KI10	A2	1	1	0.5	2.5
KI10	A2	1	1	0.5	2.5
KI10	A2	1	1	0.5	2.5
KI10	A2	1	1	0.5	2.5
KI10	A2	1	1	0.5	2.5
KI10	A2	1	1	0.5	2.5
KI10	A2	1	1	0.5	2.5
KI10	A2	1	1	0.5	2.5
KI10	A2	1	1	0.5	2.5
KI10	A2	1	1	0.5	2.5
KI10	A2	1	1	0.5	2.5
KI10	A2	1	1	0.5	2.5
KI10	A2	1	1	0.5	2.5
KI10	A2	1	1	0.5	2.5
JO26	A2	0	1	0.5	1.5
JO26	A2	0	1	0.5	1.5
JO26	A2	0	1	0.5	1.5
JO26	A2	0	1	0.5	1.5
JO26	A2	0	1	0.5	1.5
JO26	A2	0	1	0.5	1.5
JO26	A2	0	1	0.5	1.5
JO26	A2	0	1	0.5	1.5
JO26	A2	0	1	0.5	1.5
JO26	A2	0	1	0.5	1.5
JO26	A2	0	1	0.5	1.5
KA10b	A2	0	1	0.5	1.5
KA10b	A2	1	1	0.5	2.5
KA10b	A2	1	1	0.5	2.5
KA10b	A2	1	1	0.5	2.5
KA10b	A2	1	1	0.5	2.5
KA10b	A2	1	1	0	2
KA10b	A2	1	1	0.5	2.5
KA10b	A2	0	1	0	1
KA10b	A2	0	1	0	1
KA10b	A2	1	1	0.5	2.5
KA10b	A2	1	0	0	1
KA10b	A2	1	0	0	1
DA19	A2	1	1	0.5	2.5
DA19	A2	1	1	0.5	2.5
DA19	A2	1	1	0.5	2.5
DA19	A2	1	1	0.5	2.5
DA19	A2	1	1	0.5	2.5
DA19	A2	1	1	0.5	2.5
DA19	A2	1	1	0.5	2.5
DA19	A2	1	1	0.5	2.5
DA19	A2	1	1	0.5	2.5
DA19	A2	1	1	0	2
DA19	A2	1	1	0.5	2.5
LI09	A2	1	1	0.5	2.5
LI09	A2	1	1	0.5	2.5
LI09	A2	1	1	0.5	2.5
LI09	A2	1	1	0.5	2.5

LI09	A2	1	1	0.5	2.5
LI09	A2	1	1	0.5	2.5
LI09	A2	1	1	0.5	2.5
LI09	A2	1	1	0.5	2.5
LI09	A2	1	1	0.5	2.5
LI09	A2	1	1	0.5	2.5
LI09	A2	1	1	0.5	2.5
LI09	A2	1	1	0.5	2.5
LI09	A2	1	1	0.5	2.5
CH21	A2	1	1	0.5	2.5
CH21	A2	1	1	0.5	2.5
CH21	A2	1	1	0.5	2.5
CH21	A2	1	1	0.5	2.5
CH21	A2	1	1	0.5	2.5
CH21	A2	1	1	0.5	2.5
CH21	A2	1	1	0.5	2.5
CH21	A2	1	1	0.5	2.5
CH21	A2	1	1	0.5	2.5
CH21	A2	1	1	0.5	2.5
CH21	A2	1	1	0.5	2.5
CH21	A2	1	1	0.5	2.5
CH21	A2	1	1	0.5	2.5
SU11A	A2	0	1	0.5	1.5
SU11A	A2	0	1	0.5	1.5
SU11A	A2	0	1	0.5	1.5
SU11A	A2	0	1	0.5	1.5
SU11A	A2	0	1	0.5	1.5
JO04b	A2	0	1	0.5	1.5
JO04b	A2	0	1	0.5	1.5
JO04b	A2	0	1	0.5	1.5
JO04b	A2	0	1	0.5	1.5
JO04b	A2	0	1	0.5	1.5
JO04b	A2	0	1	0.5	1.5
JO04b	A2	0	1	0.5	1.5
JO04b	A2	0	1	0.5	1.5
JO04b	A2	0	1	0.5	1.5
JO04b	A2	0	1	0.5	1.5
JO04b	A2	0	1	0.5	1.5
JO04b	A2	0	1	0.5	1.5
JO04b	A2	0	1	0.5	1.5
JO04b	A2	0	1	0.5	1.5
JO04b	A2	0	1	0.5	1.5
JO04b	A2	0	0	0	0

Appendix E. Variety Results

B1																			
ID	P-Code	Geometry	Kinematics	Forces	Energy	Material	Signals	Safety	Ergonomics	Production	Quality Control	Assembly	Transport	Operation	Maintenance	Recycling	Costs	Schedules	N/A
AN09	B1											x							
AN09	B1	x		x															
AN09	B1				x														
AN09	B1							x											
AN09	B1													x					
AN09	B1											x							
AN09	B1	x							x										
AN09	B1																x		
AN09	B1											x		x					
GI21	B1																		x
GI21	B1	x							x					x					
GI21	B1	x		x															
GI21	B1																x		
GI21	B1														x				
GI21	B1													x					
GI21	B1											x		x					
GI21	B1								x										
CH15	B1	x																	
CH15	B1							x											
CH15	B1											x							
CH15	B1	x						x											
CH15	B1					x													
CH15	B1							x											
CH15	B1							x											
CH15	B1											x							
CH15	B1								x			x							
CH15	B1			x															
CH15	B1			x							x								
CH15	B1													x					
SU02	B1								x			x							

SU02	B1	x																	
SU02	B1			x							x								
SU02	B1							x											
SU02	B1							x											
SU02	B1	x										x							
SU02	B1											x							
SU02	B1								x										
SU02	B1											x							
LO01	B1										x				x				
LO01	B1			x															
LO01	B1																		x
LO01	B1	x																	
LO01	B1																x		
LO01	B1									x		x							
LO01	B1											x							
LO01	B1											x							
LO01	B1					x									x				
LO01	B1								x										
LO01	B1													x					
LO01	B1							x				x							
LO01	B1													x					
LO01	B1					x		x											
LO01	B1							x											
LO01	B1											x		x					
LO01	B1									x									
LO01	B1									x									
JU02	B1																		x
JU02	B1											x							
JU02	B1											x		x	x				
JU02	B1								x					x					
JU02	B1																x		
JU02	B1													x					
JU02	B1									x					x				

LO03	B1			x							x			x					
LO03	B1								x					x					
LO03	B1											x							
LO03	B1																x		
LO03	B1	x		x															
LO03	B1											x		x					
LO03	B1							x			x								
LO03	B1													x					
AM20	B1	x		x															
AM20	B1											x							
AM20	B1									x				x					
AM20	B1													x					
AM20	B1											x							
AM20	B1											x							
AM20	B1			x															
AM20	B1					x											x		
AM20	B1											x							
MA19	B1											x							
MA19	B1	x		x															
MA19	B1														x				
MA19	B1																x		
MA19	B1											x							
MA19	B1											x							
MA19	B1							x						x					
MA19	B1									x									
MA19	B1										x				x				
MA19	B1							x						x					
MA19	B1							x											
MA19	B1							x											
MA19	B1								x										

MA19	B1				x														
MA19	B1							x	x										
MA19	B1					x									x				
MA19	B1									x									
MA19	B1										x				x				
MA19	B1							x											
MA19	B1																		x
MA19	B1																		x
SA11	B1											x							
SA11	B1	x		x															
SA11	B1																x		
SA11	B1											x							
SA11	B1	x							x										
SA11	B1														x				
SA11	B1																		
SA11	B1											x							
SA11	B1					x													
JE06	B1											x							
JE06	B1											x							
JE06	B1														x				
JE06	B1											x							
JE06	B1	x																	
JE06	B1	x		x															
JE06	B1																x		
JE06	B1					x			x										
JE06	B1			x		x													
JE06	B1													x					
JE06	B1											x							
JE06	B1																		x
JE06	B1	x							x										
JE06	B1										x								
JE06	B1							x	x										
JE06	B1							x											
JE06	B1							x						x					
JE10	B1																		x
JE10	B1													x					
JE10	B1											x							
JE10	B1											x		x					
JE10	B1																		x
JE10	B1														x				
JE10	B1	x		x										x					
JE10	B1											x							

JE10	B1	x		x															
JE10	B1																x		
JE10	B1													x					
JE10	B1													x					
JE10	B1											x							
JE10	B1														x				
JE10	B1										x								
JE10	B1							x						x					
TA06	B1					x													
TA06	B1																x		
TA06	B1					x					x				x				
TA06	B1										x			x					
TA06	B1							x											
TA06	B1											x		x					
TA06	B1										x								
TA06	B1									x		x		x					
TA06	B1										x			x	x				
TA06	B1	x																	
TA06	B1										x								
TA06	B1											x							
TA06	B1														x				
TA06	B1		x																
TA06	B1													x					
BR02	B1											x							
BR02	B1													x					
BR02	B1			x															
BR02	B1	x																	
AN11	B1			x															
AN11	B1														x				
AN11	B1											x							
AN11	B1													x					
AN11	B1																		x
AN11	B1												x						

AN11	B1												x						
KA05	B1													x					
KA05	B1	x																	
KA05	B1			x															
KA05	B1																x		
KA05	B1											x							
KA05	B1										x								
KA05	B1											x		x					
KA05	B1					x		x											
CI26	B1																		x
CI26	B1											x							
CI26	B1											x							
CI26	B1											x							
CI26	B1	x																	
CI26	B1			x															
CI26	B1																x		
CI26	B1														x				
LY04	B1											x							
LY04	B1														x				
LY04	B1											x							
LY04	B1	x																	
LY04	B1			x															
LY04	B1																x		
LY04	B1							x											
LY04	B1			x															
LY04	B1													x					
LY04	B1													x					
LY04	B1					x					x								
JE17	B1							x						x					
JE17	B1											x		x					
JE17	B1											x							
JE17	B1			x															
JE17	B1	x							x										
JE17	B1											x							
JE17	B1			x		x													
JE17	B1					x					x								
JE17	B1																x		
SA06	B1																		x
SA06	B1											x							
SA06	B1											x							
SA06	B1	x																	
SA06	B1			x															
SA06	B1																x		

MA02	B1											x							
MA02	B1					x		x											
MA02	B1													x					
MA02	B1											x							
MA02	B1	x																	
MA02	B1																x		
MA02	B1	x																	
MA02	B1								x					x					
MA02	B1			x															
MA02	B1					x								x					
MA02	B1										x				x				
MA02	B1											x							
MA02	B1											x							
CA11	B1											x							
CA11	B1											x							
CA11	B1										x				x				
CA11	B1							x			x								
CA11	B1													x					
CA11	B1										x								
CA11	B1										x								
MA01a	B1													x					
MA01a	B1		x						x					x					
MA01a	B1													x					
MA01a	B1										x								
JO04	B1																x		
JO04	B1			x															
JO04	B1		x						x										
JO04	B1																		
JO04	B1													x					
JO04	B1											x							
JO04	B1										x				x				
JO04	B1											x		x					
JO04	B1			x															
JO04	B1					x				x	x								

LA07	B1							x						x					
LA07	B1													x					
LA07	B1			x															
LA07	B1																x		
LA07	B1	x											x						
LA07	B1											x							
LA07	B1		x											x					
MI16	B1													x					
MI16	B1			x															
MI16	B1																x		
MI16	B1							x				x		x					
MI16	B1										x	x							
MI16	B1											x							
MI16	B1	x							x										
MI16	B1	x																	
CH02	B1	x										x							
CH02	B1	x										x							
CH02	B1											x		x					
CH02	B1			x		x					x								
CH02	B1													x					
CH02	B1			x		x		x											
LI14	B1											x		x					
LI14	B1														x				
LI14	B1											x							
LI14	B1							x	x					x					
LI14	B1									x							x		
LI14	B1		x	x															
CH11	B1																		
CH11	B1																		
CH11	B1																		
CH11	B1																		
CH11	B1																		

CH11	B1																		
CH11	B1																x		
CH11	B1																		
CH11	B1																		
CH11	B1																		
CH11	B1																		
TE30	B1			x															
TE30	B1	x																	
TE30	B1											x		x					
TE30	B1	x																	
TE30	B1																x		
TE30	B1											x							
TE30	B1											x							
TE30	B1								x										
TE30	B1											x		x					
TE30	B1					x		x											
TE30	B1					x											x		
MA01b	B1																		x
MA01b	B1											x		x					
MA01b	B1											x							
MA01b	B1	x	x																
MA01b	B1			x															
MA01b	B1																x		
MA01b	B1										x								
BA23	B1																x		
BA23	B1			x															
BA23	B1											x							
BA23	B1		x						x					x					
BA23	B1											x							
BA23	B1											x							
BA23	B1													x					
BA23	B1	x																	
BA23	B1										x				x				
BA23	B1			x		x									x				
BA23	B1									x		x							

KA19	B1											x		x					
KA19	B1											x							
KA19	B1			x															
KA19	B1					x				x							x		
KA19	B1	x																	
KA19	B1	x																	
KA19	B1														x				
KA19	B1								x										
KA19	B1					x													
TA18	B1											x							
TA18	B1											x							
TA18	B1							x						x					
TA18	B1	x	x																
TA18	B1			x		x													
TA18	B1																x		
TA18	B1									x									
TA18	B1													x					
TA18	B1							x						x					
TA18	B1					x		x											
TA18	B1													x					
DE09	B1		x											x					
DE09	B1		x	x															
DE09	B1							x						x					
DE09	B1											x							
DE09	B1											x							
DE09	B1											x		x					
DE09	B1			x								x		x					
KA09	B1											x		x					
KA09	B1											x							
KA09	B1	x																	

KA09	B1																x		
PE06	B1																		x
PE06	B1			x															
PE06	B1					x													
PE06	B1					x		x			x								
PE06	B1					x				x									
PE06	B1													x					
PE06	B1											x							
PE06	B1											x							
PE06	B1																x		
PE06	B1											x							
PE06	B1	x																	
PE06	B1								x								x		
PE06	B1													x					
AS17	B1							x											
AS17	B1													x					
AS17	B1														x				
AS17	B1											x							
AS17	B1											x							
AS17	B1	x		x															
AS17	B1																x		
AS17	B1	x																	
AS17	B1													x					
RO02	B1											x		x					
RO02	B1							x			x				x				
RO02	B1	x	x						x										
RO02	B1			x															
RO02	B1																x		
RO02	B1									x									
TO09	B1													x					

TO09	B1			x															
TO09	B1																x		
TO09	B1			x															
TO09	B1										x								
TO09	B1													x					
TO09	B1	x																	
TO09	B1											x							
TO09	B1										x								
SO07	B1													x					
SO07	B1											x							
SO07	B1											x							
SO07	B1									x									
SO07	B1																x		
SO07	B1										x								
SO07	B1					x		x											
SO07	B1			x															
BH15	B1													x					
BH15	B1														x				
BH15	B1											x							
BH15	B1											x							
BH15	B1			x															
BH15	B1	x							x										
BH15	B1	x																	
BH15	B1																x		
BH15	B1			x															
BH15	B1									x									
BH15	B1													x					
BH15	B1														x				
BH15	B1										x								
BH15	B1			x															

BH15	B1	x																	
BH15	B1											x							
BH15	B1													x					
BH15	B1									x		x							
BH15	B1													x					
BH15	B1							x											
BH15	B1										x								
CA21	B1											x		x					
CA21	B1											x							
CA21	B1										x								
CA21	B1								x										
CA21	B1											x							
CA21	B1													x					
CA21	B1													x					
CA21	B1					x													
CA21	B1											x							
CA21	B1																x		
CA21	B1					x										x			
KI10	B1	x																	
KI10	B1			x															
KI10	B1																x		
KI10	B1														x				
KI10	B1							x											
KI10	B1													x					
KI10	B1													x					
KI10	B1											x							
KI10	B1											x							
KI10	B1								x			x							
JO26	B1					x		x											
JO26	B1									x									
JO26	B1											x							
JO26	B1	x																	
JO26	B1			x															
JO26	B1																x		
JO26	B1														x				
JO26	B1														x				
JO26	B1										x								
JO26	B1																		x
KA10b	B1									x									

KA10b	B1											x							
KA10b	B1	x																	
KA10b	B1																x		
KA10b	B1											x							
KA10b	B1		x											x					
KA10b	B1													x	x				
KA10b	B1			x															
KA10b	B1							x											
DA19	B1			x															
DA19	B1											x							
DA19	B1								x										
DA19	B1													x					
DA19	B1											x							
DA19	B1			x															
DA19	B1					x					x								
LI09	B1	x																	
LI09	B1			x							x								
LI09	B1											x							
LI09	B1											x							
LI09	B1					x									x				
LI09	B1					x								x					
LI09	B1					x											x		
CH21	B1											x							
CH21	B1											x							
CH21	B1														x				
CH21	B1		x											x					
CH21	B1			x															
CH21	B1																x		
CH21	B1											x							
SU11A	B1									x							x		
SU11A	B1			x															
SU11A	B1											x							
SU11A	B1											x							

ID	P-Code	Geometry	Kinematics	Forces	Energy	Material	Signals	Safety	Ergonomics	Production	Quality Control	Assembly	Transport	Operation	Maintenance	Recycling	Costs	Schedules	N/A
SU11A	B1								x					x					
JO04b	B1											x					x		
JO04b	B1											x							
JO04b	B1											x							
JO04b	B1											x		x					
JO04b	B1	x							x										
JO04b	B1			x															
JO04b	B1																x		
JO04b	B1										x								
JO04b	B1														x				
JO04b	B1													x					

A1																			
ID	**P-Code**	**Geometry**	**Kinematics**	**Forces**	**Energy**	**Material**	**Signals**	**Safety**	**Ergonomics**	**Production**	**Quality Control**	**Assembly**	**Transport**	**Operation**	**Maintenance**	**Recycling**	**Costs**	**Schedules**	**N/A**
SU08	A1							x											
SU08	A1	x							x					x					
SU08	A1													x					
SU08	A1											x							
SU08	A1	x								x									
SU08	A1	x												x					
SU08	A1													x					
SU08	A1													x					
SU08	A1	x												x					
SU08	A1				x														
SU08	A1			x										x					
MA11a	A1							x						x					
MA11a	A1																		x
MA11a	A1													x					
MA11a	A1													x					

M A1 1a	A1	x																	
M A1 1a	A1													x					
M A1 1a	A1								x					x					
SH 21	A1													x					
SH 21	A1			x					x					x					
SH 21	A1							x						x					
SH 21	A1																		x
SH 21	A1											x							
SH 21	A1													x					
SH 21	A1	x																	
SH 21	A1													x					
SH 21	A1	x												x					
SH 21	A1													x					
SH 21	A1							x	x										
SH 21	A1													x					
AL 14	A1							x											
AL 14	A1													x					
AL 14	A1													x					
AL 14	A1										x								
AL 14	A1	x																	
AL 14	A1			x				x											
AL 14	A1					x													
AL 14	A1							x	x										
AL 14	A1																x		
AL 14	A1													x					
AL 14	A1										x				x				
KR 20	A1													x					
KR 20	A1							x											
KR 20	A1													x					
KR 20	A1											x							
KR 20	A1													x					
KR 20	A1													x					
KR 20	A1													x					

KR 20	A1								x					x					
MI 18	A1							x											
MI 18	A1												x	x					
MI 18	A1													x					
MI 18	A1	x																	
MI 18	A1											x							
MI 18	A1											x							
MI 18	A1									x		x							
MI 18	A1											x		x					
MI 18	A1									x							x		
MI 18	A1													x					
MI 18	A1							x						x					
MI 18	A1													x					
MI 18	A1		x											x					
MI 18	A1			x															
MI 18	A1					x		x											
MI 18	A1									x	x								
KA 10	A1	x																	
KA 10	A1	x																	
KA 10	A1							x						x					
KA 10	A1													x					
KA 10	A1							x						x					
KA 10	A1									x									
KA 10	A1		x																
KA 10	A1													x					
KA 10	A1											x		x					
KA 10	A1													x					
M A1 1b	A1							x											
M A1 1b	A1													x					
M A1 1b	A1									x				x					
M A1 1b	A1	x																	
M A1 1b	A1								x										

M A1 1b	A1													x					
M A1 1b	A1													x					
M E1 1	A1							x											
M E1 1	A1	x	x											x					
M E1 1	A1							x						x					
M E1 1	A1			x										x					
M E1 1	A1													x					
M E1 1	A1											x		x					
M E1 1	A1											x							
W E3 1	A1							x	x										
W E3 1	A1											x							
W E3 1	A1			x															
W E3 1	A1	x																	
W E3 1	A1	x																	
W E3 1	A1	x																	
W E3 1	A1			x															
W E3 1	A1	x		x															
BE 02	A1	x																	
BE 02	A1													x					
BE 02	A1							x						x					
BE 02	A1											x							
BE 02	A1												x						
BE 02	A1													x					
LA 04	A1													x					
LA 04	A1	x												x					
LA 04	A1													x					

LA 04	A1																x		
LA 04	A1	x											x						
MI 02	A1							x											
MI 02	A1																		x
MI 02	A1													x					
MI 02	A1													x					
MI 02	A1											x							
MI 02	A1											x							
MI 02	A1													x					
MI 02	A1	x																	
MI 02	A1							x											
MI 02	A1								x										
MI 02	A1			x															
MI 02	A1		x											x					
MI 02	A1												x						
MI 02	A1																x		
PA 27	A1							x											
PA 27	A1																		x
PA 27	A1													x					
PA 27	A1													x					
PA 27	A1								x										
PA 27	A1	x																	
PA 27	A1									x		x							
PA 27	A1													x					
NA21	A1	x																	
NA21	A1							x											
NA21	A1																		x
NA21	A1													x					
NA21	A1											x							
NA21	A1					x				x							x		
NA21	A1	x				x													

N A2 1	A1									x									
N A2 1	A1		x					x											
N A2 1	A1			x															
N A2 1	A1	x																	
N A2 1	A1									x									
N A2 1	A1													x					
N A2 1	A1					x					x								
MI 29	A1							x											
MI 29	A1																		x
MI 29	A1													x					
MI 29	A1													x					
MI 29	A1	x																	
MI 29	A1											x							
MI 29	A1											x							
M L0 2	A1							x											
M L0 2	A1													x					
M L0 2	A1													x					
M L0 2	A1	x																	
DA 02	A1							x											
DA 02	A1								x										
DA 02	A1																		x
DA 02	A1	x																	
DA 02	A1													x					
DA 02	A1		x																
DA 02	A1													x					
DA 02	A1								x										
DA 02	A1											x							
DA 02	A1																x		
DA 02	A1								x	x									

DA 02	A1														x				
DA 02	A1														x				
DA 02	A1													x					
DA 02	A1													x					
DA 02	A1													x					
DA 02	A1														x				
DA 02	A1													x					
KI 01	A1							x											
KI 01	A1														x				
KI 01	A1													x					
KI 01	A1											x							
KI 01	A1																x		
KI 01	A1	x																	
KI 01	A1									x									
KI 01	A1									x				x					
KI 01	A1													x					
KI 01	A1													x					
KI 01	A1	x																	
KI 01	A1										x				x				
KI 01	A1		x																
KI 01	A1									x									
KI 01	A1													x					
KI 01	A1													x					
KI 01	A1													x					
KI 01	A1									x							x		
KI 01	A1	x											x						
LI11	A1							x											
LI11	A1													x					
LI11	A1											x							
LI11	A1	x																	
LI11	A1																		x
LI11	A1									x		x							
LI11	A1													x					
LI11	A1													x					

JA 12	A1	x												x					
JA 12	A1							x											
JA 12	A1													x					
JA 12	A1											x							
JA 12	A1													x					
LA 11	A1													x					
LA 11	A1							x											
LA 11	A1	x												x					
LA 11	A1													x					
LA 11	A1											x							
LA 11	A1								x										
LA 11	A1							x				x							
LA 11	A1													x					
LA 11	A1														x				
LA 11	A1										x				x				
LA 11	A1																x		
LA 11	A1				x														
LA 11	A1		x																
LA 11	A1										x								
LE 08	A1	x																	
LE 08	A1			x															
LE 08	A1								x					x					
LE 08	A1								x					x					
LE 08	A1													x					
CH 01	A1							x											
CH 01	A1													x					
CH 01	A1	x																	
CH 01	A1													x					
CH 01	A1											x							
CH 01	A1													x					
CH 01	A1	x																	
CH 01	A1			x															
CH 01	A1							x											
KA 02	A1													x					

KA 02	A1	x												x					
KA 02	A1							x											
KA 02	A1																		x
KA 02	A1													x					
KA 02	A1													x					
KA 02	A1													x					
KA 02	A1											x							
KA 02	A1													x					
KA 02	A1													x					
KA 02	A1													x					
KA 02	A1													x					
KA 02	A1											x							
KA 02	A1											x							
KA 02	A1													x					
SH 16	A1							x											
SH 16	A1			x										x					
SH 16	A1													x					
SH 16	A1													x					
SH 16	A1											x							
SH 16	A1											x							
SH 16	A1	x																	
SH 16	A1							x						x					
BA 25	A1							x											
BA 25	A1													x					
BA 25	A1									x									
BA 25	A1																x		
BA 25	A1													x					
BA 25	A1													x					
BA 25	A1														x				
BA 25	A1	x																	
BA 25	A1							x											
JE 11	A1							x											
JE 11	A1								x			x							
JE 11	A1	x																	

JE 11	A1																x		
JE 11	A1													x					
JE 11	A1								x										
JE 11	A1							x											
JE 11	A1													x					
MI 29 a	A1		x																
MI 29 a	A1							x											
MI 29 a	A1																		x
MI 29 a	A1													x					
MI 29 a	A1													x					
MI 29 a	A1	x																	
MI 29 a	A1											x							
MI 29 a	A1											x							
MI 29 a	A1													x					
MI 29 b	A1	x																	
MI 29 b	A1							x											
MI 29 b	A1													x					
MI 29 b	A1													x					
MI 29 b	A1													x					
MI 29 b	A1													x					
MI 29 b	A1													x					
MI 29 b	A1											x							
MI 29 b	A1													x					
MI 29 b	A1	x												x					
MI 29 b	A1							x											

MI 29 b	A1											x							
LA 03	A1											x							
LA 03	A1											x							
LA 03	A1											x							
LA 03	A1											x							
LA 03	A1													x					
LA 03	A1											x							
LA 03	A1													x					
LA 03	A1													x					
LA 03	A1					x													
SO 05	A1								x										
SO 05	A1							x											
SO 05	A1	x																	
SO 05	A1													x					
SO 05	A1													x					
SO 05	A1											x		x					
SO 05	A1											x							
SO 05	A1													x					
KU 92	A1			x															
KU 92	A1													x					
KU 92	A1							x	x										
KU 92	A1							x	x										
KU 92	A1							x						x					
KU 92	A1		x																
KU 92	A1	x												x					
KU 92	A1														x				
KU 92	A1															x			
KU 92	A1					x		x											
KU 92	A1								x					x					
LA 22	A1							x											
LA 22	A1																		x
LA 22	A1													x					
LA 22	A1										x			x					
LA 22	A1											x							

LA 22	A1											x							
LA 22	A1										x			x					
LA 22	A1	x																	
LA 22	A1										x								
LA 22	A1																x		
LA 22	A1												x						
LA 22	A1														x				
LA 22	A1							x						x					
SA 04	A1							x											
SA 04	A1																		x
SA 04	A1													x					
SA 04	A1													x					
SA 04	A1											x		x					
SA 04	A1											x							
SA 04	A1	x																	
RE 05	A1											x							
RE 05	A1							x											
RE 05	A1							x	x										
RE 05	A1							x											
RE 05	A1																		x
RE 05	A1											x							
RE 05	A1											x							
M A0 8	A1													x					
M A0 8	A1													x					
M A0 8	A1				x						x			x					
M A0 8	A1	x																	
M A0 8	A1												x						
SU 14	A1							x											
SU 14	A1													x					
SU 14	A1													x					
SU 14	A1													x					
SU 14	A1	x																	

SU 14	A1											x							
SU 14	A1										x			x					
SU 14	A1													x					
SU 14	A1											x							
SU 14	A1											x							
SU 14	A1		x											x					
SU 14	A1													x					
SU 14	A1																x		
SU 14	A1											x							
SU 14	A1													x					
SU 11 B	A1							x											
SU 11 B	A1													x					
SU 11 B	A1		x																
SU 11 B	A1									x									
SU 11 B	A1											x							
SU 11 B	A1	x																	
SU 11 B	A1													x					
SU 11 B	A1													x					
SU 11 B	A1													x					
SU 11 B	A1											x							
TE 27	A1	x																	
TE 27	A1													x					
TE 27	A1													x					
TE 27	A1										x								
TE 27	A1													x					
TE 27	A1													x					
TE 27	A1			x															
TE 27	A1													x					
TE 27	A1																x		

JA 04 b	A1	x																	
JA 04 b	A1							x											
JA 04 b	A1													x					
JA 04 b	A1									x									
JA 04 b	A1								x					x					
JA 04 b	A1			x										x					
JA 04 b	A1			x															
VI 10	A1	x																	
VI 10	A1							x											
VI 10	A1													x					
VI 10	A1									x			x						
VI 10	A1											x							
VI 10	A1		x											x					
VI 10	A1											x							
VI 10	A1													x					
VI 10	A1			x															
VI 10	A1		x							x				x					
VI 10	A1													x					
VI 10	A1													x					
MI 09	A1	x																	
MI 09	A1							x											
MI 09	A1													x					
MI 09	A1													x					
MI 09	A1													x					
MI 09	A1													x					
MI 09	A1											x							
MI 09	A1													x					
MI 09	A1		x											x					
MI 09	A1									x									
MI 09	A1	x												x					
MI 09	A1													x					

MI 09	A1													x					
MI 09	A1													x					
A N2 4	A1													x					
A N2 4	A1	x																	
A N2 4	A1													x					
A N2 4	A1							x	x										
A N2 4	A1			x															
A N2 4	A1			x															
A N2 4	A1			x															
A N2 4	A1			x															
A N2 4	A1		x																
A N2 4	A1	x																	
A N2 4	A1													x					
A N2 4	A1																		x
A N2 4	A1																		x
A N2 4	A1														x				
DI 15	A1							x	x										
DI 15	A1								x					x					
DI 15	A1									x									
DI 15	A1			x															
DI 15	A1									x							x		
DI 15	A1											x							
DI 15	A1			x										x					
DI 15	A1													x					
DI 15	A1	x																	
DI 15	A1			x					x										
DI 15	A1				x														

DI 15	A1													x					
DI 15	A1													x					
DI 15	A1							x	x										
M A2 2	A1	x																	
M A2 2	A1							x	x										
M A2 2	A1													x					
M A2 2	A1													x					
M A2 2	A1											x							
M A2 2	A1													x					
M A2 2	A1							x			x								
M A2 2	A1											x							
GI 17	A1							x				x							
GI 17	A1								x										
GI 17	A1			x															
GI 17	A1													x					
GI 17	A1	x												x					
GI 17	A1											x							
GI 17	A1			x										x					
A M 05	A1			x															
A M 05	A1					x													
A M 05	A1													x					
A M 05	A1			x															
A M 05	A1									x									
A M 05	A1							x	x										
A M 05	A1								x					x					
A M 05	A1	x												x					

LI04	A1													x					
LI04	A1																		x
LI04	A1													x					
LI04	A1													x					
LI04	A1										x								
LI04	A1														x				
LI04	A1																x		
LI04	A1													x					
LI04	A1													x					
LI04	A1				x														
LI04	A1											x							
LI04	A1			x															
LI04	A1											x							
RE08	A1							x											
RE08	A1													x					
RE08	A1													x					
RE08	A1																		x
RE08	A1									x		x							
RE08	A1													x					
RE08	A1	x																	
RE08	A1																		x
RE08	A1																		x
GE08	A1													x					
GE08	A1													x					
GE08	A1							x											
GE08	A1		x											x					
GE08	A1																		x
GE08	A1									x		x							
GE08	A1	x																	
GE08	A1	x												x					
GE08	A1													x					
MA15	A1							x											
MA15	A1							x											

MA15	A1							x											
MA15	A1													x					
MA15	A1													x					
MA15	A1													x					
MA15	A1	x																	
MA15	A1											x							
MA15	A1																		x
MA15	A1									x									
MA15	A1				x														
CH05	A1	x												x					
CH05	A1							x											
CH05	A1													x					
CH05	A1									x									
CH05	A1																		x
CH05	A1													x					
CH05	A1											x							
CH05	A1	x												x					
VI20	A1	x																	
VI20	A1							x											
VI20	A1													x					
VI20	A1							x						x					
VI20	A1											x							
VI20	A1													x					
VI20	A1											x							
CH06	A1							x											
CH06	A1													x					
CH06	A1											x							
CH06	A1	x												x					
CH06	A1																		x
CH06	A1																x		

CH06	A1																		x
JU22	A1							x											
JU22	A1							x											
JU22	A1	x												x					
JU22	A1													x					
JU22	A1	x																	
JU22	A1														x				
JU22	A1													x					
JU22	A1									x									
JU22	A1											x							
JU22	A1			x										x					
JU22	A1													x					
JU22	A1											x							
JU22	A1											x							
JU22	A1								x					x					
JU22	A1																		x
JU22	A1													x					
JU22	A1			x															
JU22	A1									x									
JU22	A1								x										
ME12	A1									x									
ME12	A1													x					
ME12	A1							x											
ME12	A1													x					
ME12	A1	x												x					
ME12	A1											x							
ME12	A1													x					
CH09	A1													x					
CH09	A1													x					
CH09	A1													x					
CH09	A1													x					

CH 09	A1													x					
CH 09	A1							x											
CH 09	A1	x												x					
CH 09	A1	x												x					
CH 09	A1							x											
CH 09	A1											x							
CH 09	A1													x					
CH 09	A1											x							
CH 09	A1													x					
KI 12	A1	x												x					
KI 12	A1							x			x								
KI 12	A1													x					
KI 12	A1												x	x					
KI 12	A1													x					
KI 12	A1			x										x					
KI 12	A1													x					
KI 12	A1													x					
KI 12	A1		x																
KI 12	A1							x	x										
KI 12	A1							x	x										
DE 15	A1							x											
DE 15	A1																		x
DE 15	A1		x																
DE 15	A1											x							
DE 15	A1	x																	
DE 15	A1													x					
DE 15	A1	x																	
DE 15	A1			x															
DE 15	A1					x													
LI0 4b	A1							x											
LI0 4b	A1																		x
LI0 4b	A1													x					
LI0 4b	A1													x					
LI0 4b	A1											x							

LI0 4b	A1											x							
LI0 4b	A1			x										x					
LI0 4b	A1	x																	
LI0 4b	A1									x									
LI0 4b	A1													x					
LI0 4b	A1													x					
LI0 4b	A1								x										
LI0 4b	A1														x				
LI0 4b	A1													x					
LI0 4b	A1	x																	
LI0 4b	A1													x					
LI0 4b	A1																x		
JO 24	A1			x															
JO 24	A1													x					
JO 24	A1		x											x					
JO 24	A1											x							
JO 24	A1	x																	
JO 24	A1													x					
A N1 8	A1	x												x					
A N1 8	A1													x					
A N1 8	A1									x									
A N1 8	A1													x					
A N1 8	A1							x											
A N1 8	A1																		x
A N1 8	A1													x					
M E2 5	A1							x											
M E2 5	A1																		x
M E2 5	A1													x					
M E2 5	A1																		x

ME25	A1											x							
ME25	A1											x							
ME25	A1											x							
ME25	A1													x					
ME25	A1									x							x		
ME25	A1									x									
ME25	A1	x																	
ME25	A1			x															
ME25	A1													x					
ME25	A1			x															
VI01	A1							x											
VI01	A1	x							x										
VI01	A1					x			x										
VI01	A1											x							
VI01	A1			x															
VI01	A1	x																	
VI01	A1	x																	
MA12	A1							x											
MA12	A1																		x
MA12	A1													x					
MA12	A1													x					
MA12	A1									x									
MA12	A1	x																	
MA12	A1																x		
MA12	A1			x															

MA12	A1									x		x							
MA12	A1											x							
MA12	A1														x				
MA12	A1											x							
MA12	A1													x					
MA12	A1											x							
KA02b	A1							x											
KA02b	A1							x											
KA02b	A1			x															
KA02b	A1													x					
KA02b	A1													x					
KA02b	A1					x			x										
KA02b	A1											x							
SA04b	A1	x																	
SA04b	A1		x																
SA04b	A1							x						x					
SA04b	A1							x				x							
SA04b	A1							x				x							
SA04b	A1																		x
SA04b	A1													x					
SA04b	A1													x					
SA04b	A1																		x
SA04b	A1													x					

ID	P-Code	Geometry	Kinematics	Forces	Energy	Material	Signals	Safety	Ergonomics	Production	Quality Control	Assembly	Transport	Operation	Maintenance	Recycling	Costs	Schedules	N/A
SA04b	A1													x					
SA04b	A1			x															
SA04b	A1								x			x							
SA04b	A1	x												x					
SA04b	A1													x					
JA04	A1			x															
JA04	A1	x																	
JA04	A1								x			x							
JA04	A1				x														
JA04	A1													x					
JA04	A1	x																	
JA04	A1													x					
JA04	A1													x					
JA04	A1											x							
JA04	A1											x							
JA04	A1								x					x					
JA04	A1													x					
JA04	A1													x					

B2																			
ID	P-Code	Geometry	Kinematics	Forces	Energy	Material	Signals	Safety	Ergonomics	Production	Quality Control	Assembly	Transport	Operation	Maintenance	Recycling	Costs	Schedules	N/A
SU08	B2	x	x																
SU08	B2											x							
SU08	B2			x				x											
SU08	B2				x														
SU08	B2			x		x													
SU08	B2													x					
SU08	B2							x	x										
SU08	B2								x										

SU08	B2											x							
SU08	B2														x				
SU08	B2																x		
MA11a	B2							x						x					
MA11a	B2											x							
MA11a	B2											x							
MA11a	B2								x					x					
MA11a	B2																x		
MA11a	B2			x										x	x				
MA11a	B2													x					
MA11a	B2					x					x								
MA11a	B2									x							x		
MA11a	B2																	x	
MA11a	B2						x							x					
MA11a	B2								x										
SH21	B2																x		
SH21	B2			x															
SH21	B2			x		x													
SH21	B2					x					x								
SH21	B2													x					
SH21	B2											x							
SH21	B2											x							
SH21	B2			x		x													
SH21	B2													x					
SH21	B2											x							
SH21	B2														x				
SH21	B2													x					
SH21	B2											x							
AL14	B2													x					

AL14	B2											x							
AL14	B2													x					
AL14	B2			x										x					
AL14	B2			x										x					
AL14	B2	x	x																
AL14	B2							x											
AL14	B2					x													
AL14	B2																x		
AL14	B2														x				
AL14	B2													x					
AL14	B2													x	x				
AL14	B2									x									
AL14	B2									x		x							
KR20	B2	x																	
KR20	B2					x					x								
KR20	B2			x															
KR20	B2											x							
KR20	B2											x							
KR20	B2											x							
KR20	B2			x															
KR20	B2				x					x							x		
KR20	B2				x														
KR20	B2							x	x										
KR20	B2								x					x					
KR20	B2													x					
KR20	B2																x		
MI18	B2	x																	
MI18	B2	x																	
MI18	B2			x															

MI18	B2											x							
MI18	B2	x										x							
MI18	B2		x																
MI18	B2			x		x													
MI18	B2			x															
MI18	B2					x					x								
MI18	B2													x					
MI18	B2								x					x					
MI18	B2	x																	
MI18	B2									x							x		
MI18	B2																x		
MI18	B2											x							
MI18	B2														x				
MI18	B2			x															
MI18	B2													x					
KA10	B2	x																	
KA10	B2	x								x									
KA10	B2											x							
KA10	B2								x					x					
KA10	B2					x													
KA10	B2										x								
KA10	B2					x					x								
KA10	B2			x		x													
KA10	B2						x												
KA10	B2													x					
KA10	B2							x											
KA10	B2					x													
KA10	B2														x				
KA10	B2							x	x										

KA10	B2										x								
KA10	B2										x								
KA10	B2									x									
MA11b	B2	x																	
MA11b	B2	x																	
MA11b	B2		x																
MA11b	B2		x																
MA11b	B2			x															
MA11b	B2					x													
MA11b	B2					x													
MA11b	B2						x												
MA11b	B2							x											
MA11b	B2								x										
MA11b	B2								x										
MA11b	B2								x										
MA11b	B2									x									
MA11b	B2										x								
MA11b	B2													x					
MA11b	B2													x					
MA11b	B2													x					
MA11b	B2														x				
MA11b	B2															x			
MA11b	B2																x		
ME11	B2											x							
ME11	B2											x							
ME11	B2											x							
ME11	B2		x																
ME11	B2					x				x									
WE31	B2			x															

WE31	B2										x								
WE31	B2					x													
WE31	B2																x		
WE31	B2							x	x										
WE31	B2											x							
WE31	B2	x																	
WE31	B2								x										
WE31	B2			x															
WE31	B2													x					
BE02	B2			x		x													
BE02	B2			x															
BE02	B2																x		
BE02	B2											x							
BE02	B2	x																	
BE02	B2											x							
BE02	B2							x	x										
BE02	B2								x										
LA04	B2																x		
LA04	B2			x															
LA04	B2														x				
LA04	B2							x											
LA04	B2									x							x		
LA04	B2											x							
LA04	B2								x					x					
LA04	B2			x															
LA04	B2													x					
LA04	B2															x			
LA04	B2			x															
LA04	B2														x				

LA04	B2					x													
LA04	B2										x								
LA04	B2					x													
LA04	B2													x					
LA04	B2							x	x										
LA04	B2																		x
MI02	B2													x					
MI02	B2			x															
MI02	B2																x		
MI02	B2											x							
MI02	B2	x																	
MI02	B2	x																	
MI02	B2														x				
MI02	B2														x				
MI02	B2										x								
MI02	B2			x															
MI02	B2														x				
MI02	B2							x			x								
MI02	B2					x													
MI02	B2											x							
MI02	B2											x							
MI02	B2													x					
MI02	B2							x	x										
PA27	B2	x																	
PA27	B2											x							
PA27	B2					x													
PA27	B2											x							
PA27	B2									x							x		
PA27	B2														x				

PA27	B2													x					
PA27	B2													x					
PA27	B2							x											
NA21	B2	x																	
NA21	B2													x					
NA21	B2											x							
NA21	B3											x							
NA21	B2							x	x										
NA21	B2					x					x								
NA21	B2													x					
NA21	B2											x							
NA21	B2					x					x								
NA21	B2			x															
NA21	B2								x										
MI29	B2													x					
MI29	B2											x							
MI29	B2																x		
MI29	B2													x					
MI29	B2											x							
MI29	B2			x															
MI29	B2													x					
MI29	B2			x															
MI29	B2	x																	
MI29	B2													x					
MI29	B2													x					
ML02	B2					x													
ML02	B2	x																	
ML02	B2													x					
ML02	B2			x															

ML02	B2									x							x		
ML02	B2																x		
ML02	B2											x							
ML02	B2					x					x								
ML02	B2													x					
DA02	B2			x															
DA02	B2		x																
DA02	B2													x					
DA02	B2													x					
DA02	B2									x									
DA02	B2					x									x				
DA02	B2									x									
DA02	B2													x					
DA02	B2														x				
DA02	B2							x											
DA02	B2													x					
KI01	B2											x							
KI01	B2																x		
KI01	B2									x									
KI01	B2							x	x										
KI01	B2													x					
KI01	B2			x															
KI01	B2										x								
KI01	B2										x								
KI01	B2					x					x								
KI01	B2	x																	
KI01	B2					x													
KI01	B2														x				
KI01	B2											x							
KI01	B2													x					
KI01	B2	x																	
LI11	B2											x		x					
LI11	B2														x				
LI11	B2											x							
LI11	B2											x							
LI11	B2	x																	
LI11	B2			x															
LI11	B2																x		
LI11	B2	x																	
LI11	B2													x					
LI11	B2													x					

LI11	B2									x									
LI11	B2							x	x										
LI11	B2										x								
LI11	B2									x									
LI11	B2								x										
JA12	B2			x															
JA12	B2											x							
JA12	B2			x															
JA12	B2										x								
JA12	B2																x		
JA12	B2	x																	
JA12	B2											x							
JA12	B2											x							
JA12	B2													x					
LA11	B2	x																	
LA11	B2													x					
LA11	B2					x					x								
LA11	B2			x															
LA11	B2																x		
LA11	B2														x				
LA11	B2											x							
LA11	B2													x					
LA11	B2											x							
LA11	B2													x					
LA11	B2														x				
LA11	B2						x												
LA11	B2										x								
LA11	B2										x								
LA11	B2										x								
LE08	B2	x																	
LE08	B2											x							
LE08	B2											x							
LE08	B2		x																
LE08	B2			x															
LE08	B2			x															
LE08	B2			x															
LE08	B2																x		
LE08	B2						x		x										
LE08	B2													x					
LE08	B2													x					
LE08	B2													x					
LE08	B2					x													

LE08	B2											x							
LE08	B2										x								
LE08	B2										x								
LE08	B2											x							
LE08	B2								x										
LE08	B2					x										x			
LE08	B2									x									
CH01	B2							x											
CH01	B2											x							
CH01	B2											x							
CH01	B2	x																	
CH01	B2			x															
CH01	B2																x		
CH01	B2													x					
CH01	B2													x					
CH01	B2														x				
CH01	B2									x									
CH01	B2								x										
CH01	B2											x		x					
KA02	B2													x					
KA02	B2			x															
KA02	B2			x															
KA02	B2																x		
KA02	B2										x								
KA02	B2													x					
KA02	B2	x																	
KA02	B2										x								
KA02	B2														x				
KA02	B2											x							
KA02	B2									x									
KA02	B2										x			x					
KA02	B2															x			

KA02	B2						x							x					
KA02	B2													x					
SH16	B2											x							
SH16	B2														x				
SH16	B2											x							
SH16	B2											x							
SH16	B2			x															
SH16	B2																x		
SH16	B2											x							
SH16	B2			x															
SH16	B2								x										
SH16	B2	x																	
SH16	B2											x							
SH16	B2								x										
SH16	B2											x							
SH16	B2										x								
SH16	B2										x								
BA25	B2														x				
BA25	B2											x							
BA25	B2											x							
BA25	B2																x		
BA25	B2													x					
BA25	B2			x															
BA25	B2													x					
BA25	B2										x								
BA25	B2										x								
BA25	B2	x																	
BA25	B2							x											
BA25	B2																x		

BA25	B2											x							
BA25	B2										x								
JE11	B2													x					
JE11	B2	x																	
JE11	B2													x					
JE11	B2											x							
JE11	B2													x					
JE11	B2																x		
JE11	B2											x							
JE11	B2														x				
JE11	B2										x								
JE11	B2														x				
JE11	B2							x	x										
JE11	B2											x							
JE11	B2											x							
JE11	B2													x					
JE11	B2										x								
JE11	B2						x							x					
JE11	B2									x									
MI29a	B2													x					
MI29a	B2													x					
MI29a	B2														x				
MI29a	B2											x							
MI29a	B2			x															
MI29a	B2	x																	
MI29a	B2																x		
MI29a	B2					x													
MI29a	B2					x													
MI29a	B2									x									
MI29a	B2													x					
MI29a	B2													x					
MI29a	B2														x				
MI29a	B2											x							
MI29a	B2	x																	
MI29a	B2													x					
MI29a	B2													x					
MI29b	B2									x							x		

MI29b	B2													x					
MI29b	B2			x															
MI29b	B2	x																	
MI29b	B2														x				
MI29b	B2											x							
MI29b	B2							x	x										
MI29b	B2			x															
MI29b	B2															x			
MI29b	B2									x									
MI29b	B2									x							x		
MI29b	B2									x									
MI29b	B2														x				
MI29b	B2														x				
MI29b	B2									x			x						
MI29b	B2									x									
MI29b	B2									x									
LA03	B2																x		
LA03	B2					x									x				
LA03	B2			x															
LA03	B2	x																	
LA03	B2													x					
LA03	B2											x							
LA03	B2			x							x								
LA03	B2										x								
LA03	B2													x					
LA03	B2													x					
LA03	B2									x									
LA03	B2												x						
LA03	B2							x											

LA03	B2							x											
LA03	B2									x									
SO05	B2											x							
SO05	B2														x				
SO05	B2											x							
SO05	B2	x																	
SO05	B2	x																	
SO05	B2			x															
SO05	B2																x		
SO05	B2													x					
SO05	B2			x															
SO05	B2									x				x					
KU92	B2			x		x													
KU92	B2													x					
KU92	B2											x							
KU92	B2									x							x		
KU92	B2																x		
KU92	B2					x													
KU92	B2							x	x										
KU92	B2													x					
KU92	B2													x					
KU92	B2		x																
KU92	B2						x												
KU92	B2			x															
KU92	B2													x					
KU92	B2													x					
KU92	B2										x								
KU92	B2														x				
KU92	B2													x					

KU92	B2										x								
LA22	B2													x					
LA22	B2											x							
LA22	B2											x							
LA22	B2											x							
LA22	B2	x																	
LA22	B2			x															
LA22	B2																x		
LA22	B2													x					
LA22	B2														x				
LA22	B2										x								
LA22	B2							x											
LA22	B2										x								
LA22	B2									x									
LA22	B2								x										
LA22	B2													x					
SA04	B2														x				
SA04	B2											x							
SA04	B2											x							
SA04	B2	x																	
SA04	B2			x															
SA04	B2																x		
SA04	B2													x					
SA04	B2													x					
SA04	B2									x									
SA04	B2										x								
SA04	B2							x											
SA04	B2														x				
SA04	B2									x									

RE05	B2					x				x									
RE05	B2			x															
RE05	B2													x					
RE05	B2													x					
RE05	B2					x													
RE05	B2			x															
RE05	B2					x													
RE05	B2																x		
RE05	B2	x																	
RE05	B2													x					
MA08	B2											x							
MA08	B2										x								
MA08	B2																x		
MA08	B2													x					
MA08	B2									x									
MA08	B2														x				
MA08	B2			x															
MA08	B2	x																	
MA08	B2							x	x										
SU14	B2																x		
SU14	B2			x															
SU14	B2													x					
SU14	B2			x															
SU14	B2													x					
SU14	B2											x							
SU14	B2											x							
SU14	B2													x					
SU14	B2										x								
SU14	B2										x								

SU14	B2														x				
SU14	B2						x												
SU14	B2							x	x										
SU14	B2													x					
SU14	B2													x					
SU14	B2	x																	
SU14	B2													x					
SU14	B2													x					
SU11B	B2													x					
SU11B	B2											x							
SU11B	B2														x				
SU11B	B2											x							
SU11B	B2											x							
SU11B	B2	x																	
SU11B	B2	x																	
SU11B	B2			x															
SU11B	B2																x		
SU11B	B2													x					
SU11B	B2													x					
SU11B	B2													x					
SU11B	B2					x								x					
SU11B	B2										x								
SU11B	B2											x							
SU11B	B2													x					
SU11B	B2	x																	
TE27	B2			x															
TE27	B2													x					
TE27	B2			x															
TE27	B2																x		
TE27	B2											x							
TE27	B2											x							
TE27	B2													x					
TE27	B2													x					

TE27	B2									x									
TE27	B2										x								
TE27	B2						x												
TE27	B2					x													
TE27	B2			x															
TE27	B2										x								
TE27	B2										x								
TE27	B2	x																	
JA04 b	B2																x		
JA04 b	B2										x								
JA04 b	B2													x					
JA04 b	B2													x					
JA04 b	B2			x															
JA04 b	B2											x							
JA04 b	B2													x					
JA04 b	B2							x	x										
JA04 b	B2	x																	
JA04 b	B2													x					
JA04 b	B2														x				
JA04 b	B2											x							
JA04 b	B2								x										
VI10	B2	x																	
VI10	B2					x					x								
VI10	B2											x							
VI10	B2																x		
VI10	B2			x															
VI10	B2											x							
VI10	B2							x	x										
VI10	B2											x							
VI10	B2					x													
VI10	B2													x					
VI10	B2													x					
MI0 9	B2													x					
MI0 9	B2											x							
MI0 9	B2											x							
MI0 9	B2	x																	
MI0 9	B2			x															
MI0 9	B2																x		

MI09	B2													x					
MI09	B2													x					
MI09	B2								x										
MI09	B2									x									
MI09	B2										x								
MI09	B2	x																	
MI09	B2													x					
AN24	B2			x															
AN24	B2													x					
AN24	B2											x							
AN24	B2																x		
AN24	B2											x							
AN24	B2													x					
AN24	B2											x							
AN24	B2	x																	
AN24	B2	x																	
AN24	B2			x															
AN24	B2										x								
AN24	B2										x								
AN24	B2													x					
AN24	B2													x					
AN24	B2							x							x				
AN24	B2									x									
AN24	B2											x							
AN24	B2														x				
DI15	B2														x				
DI15	B2									x									
DI15	B2															x			
DI15	B2							x	x										
DI15	B2									x									
DI15	B2													x					
DI15	B2			x															
DI15	B2																x		

DI15	B2										x								
DI15	B2													x					
DI15	B2							x	x										
DI15	B2													x					
DI15	B2													x					
DI15	B2				x														
DI15	B2														x				
MA22	B2			x															
MA22	B2											x							
MA22	B2			x															
MA22	B2	x																	
MA22	B2																x		
MA22	B2			x		x										x			
MA22	B2							x	x										
MA22	B2										x								
MA22	B2													x					
MA22	B2							x	x										
MA22	B2	x																	
MA22	B2													x					
MA22	B2													x					
GI17	B2			x															
GI17	B2				x														
GI17	B2			x															
GI17	B2		x									x							
GI17	B2													x					
GI17	B2							x	x										
GI17	B2																x		
GI17	B2										x								
AM05	B2	x																	
AM05	B2			x															
AM05	B2			x															
AM05	B2									x							x		
AM05	B2					x					x								
AM05	B2													x					
AM05	B2			x															
AM05	B2							x	x										

AM05	B2									x									
AM05	B2						x												
LI04	B2													x					
LI04	B2			x															
LI04	B2																x		
LI04	B2					x					x								
LI04	B2											x							
LI04	B2											x							
LI04	B2													x					
LI04	B2														x				
LI04	B2							x	x										
RE08	B2														x				
RE08	B2											x							
RE08	B2			x															
RE08	B2											x							
RE08	B2													x					
RE08	B2																x		
RE08	B2											x							
RE08	B2													x					
GE08	B2			x															
GE08	B2	x																	
GE08	B2											x							
GE08	B2														x				
GE08	B2																x		
GE08	B2										x								
GE08	B2			x															
GE08	B2	x																	
GE08	B2													x					
GE08	B2			x															
GE08	B2											x							
MA15	B2													x					
MA15	B2											x			x				
MA15	B2													x					

MA15	B2	x																	
MA15	B2			x															
MA15	B2			x															
MA15	B2				x														
MA15	B2					x													
MA15	B2					x													
MA15	B2						x												
MA15	B2						x												
MA15	B2									x									
MA15	B2													x					
MA15	B2														x				
CH05	B2			x															
CH05	B2										x								
CH05	B2														x				
CH05	B2			x															
CH05	B2											x							
CH05	B2							x											
CH05	B2													x					
CH05	B2																x		
CH05	B2									x									
CH05	B2					x													
CH05	B2													x					
CH05	B2													x					
CH05	B2													x					
CH05	B2													x					
CH05	B2													x					
CH05	B2											x							
CH05	B2													x					
VI20	B2													x					
VI20	B2													x					

VI20	B2													x					
VI20	B2																x		
VI20	B2			x									x						
VI20	B2											x							
VI20	B2										x								
VI20	B2									x									
VI20	B2														x				
CH06	B2									x							x		
CH06	B2														x				
CH06	B2			x															
CH06	B2											x							
CH06	B2											x							
CH06	B2													x					
CH06	B2							x	x										
CH06	B2			x															
CH06	B2													x					
CH06	B2														x				
CH06	B2						x							x					
CH06	B2					x													
CH06	B2													x					
CH06	B2													x					
CH06	B2													x					
CH06	B2	x																	
MA10	B2																x		
MA10	B2					x					x								
MA10	B2			x															
MA10	B2	x																	
MA10	B2			x															
MA10	B2														x				
MA10	B2													x					
MA10	B2											x							
MA10	B2					x													

MA10	B2							x	x										
MA10	B2													x					
MA10	B2	x																	
MA10	B2											x							
MA10	B2								x										
JU22	B2													x					
JU22	B2	x																	
JU22	B2											x							
JU22	B2			x															
JU22	B2																x		
JU22	B2													x					
JU22	B2										x								
JU22	B2	x																	
JU22	B2										x								
JU22	B2													x					
JU22	B2													x					
JU22	B2			x															
JU22	B2							x	x										
JU22	B2													x					
JU22	B2											x							
JU22	B2											x							
JU22	B2											x							
JU22	B2									x									
JU22	B2									x									
JU22	B2									x									
JU22	B2		x									x							
JU22	B2						x												
ME12	B2													x					
ME12	B2											x							
ME12	B2														x				
ME12	B2													x					
ME12	B2			x															
ME12	B2																x		
ME12	B2													x					
CH09	B2													x					
CH09	B2													x					
CH09	B2														x				
CH09	B2											x							
CH09	B2											x							

CH09	B2		x																
CH09	B2					x													
CH09	B2			x															
CH09	B2						x												
CH09	B2	x																	
CH09	B2			x															
CH09	B2																x		
CH09	B2								x										
CH09	B2														x				
CH09	B2													x					
KI12	B2	x																	
KI12	B2											x							
KI12	B2													x					
KI12	B2		x											x					
KI12	B2			x															
KI12	B2					x													
KI12	B2								x			x							
KI12	B2				x														
KI12	B2							x	x										
KI12	B2																x		
KI12	B2			x															
KI12	B2											x							
KI12	B2									x									
KI12	B2									x									
KI12	B2			x															
KI12	B2								x										
KI12	B2							x	x										
KI12	B2									x							x		
KI12	B2					x													
DE15	B2																x		
DE15	B2	x																	
DE15	B2											x							
DE15	B2											x							
DE15	B2			x															
DE15	B2														x				
DE15	B2					x		x											
DE15	B2											x							
DE15	B2													x					

DE15	B2							x	x										
DE15	B2									x									
DE15	B2												x						
DE15	B2												x						
DE15	B2														x				
DE15	B2															x			
DE15	B2								x										
DE15	B2											x							
DE15	B2													x					
LI04b	B2													x					
LI04b	B2											x							
LI04b	B2														x				
LI04b	B2	x																	
LI04b	B2	x																	
LI04b	B2			x															
LI04b	B2																x		
LI04b	B2										x								
LI04b	B2													x					
LI04b	B2										x								
LI04b	B2													x					
LI04b	B2													x					
LI04b	B2									x									
LI04b	B2													x					
LI04b	B2			x		x													
LI04b	B2														x				
LI04b	B2														x				
LI04b	B2															x			
LI04b	B2											x							
LI04b	B2													x					

LI04b	B2				x														
LI04b	B2	x																	
LI04b	B2								x										
LI04b	B2											x							
LI04b	B2													x					
JO24	B2																x		
JO24	B2											x							
JO24	B2	x		x															
JO24	B2					x													
JO24	B2							x											
JO24	B2											x							
JO24	B2														x				
JO24	B2									x									
AN18	B2																x		
AN18	B2																x		
AN18	B2																x		
AN18	B2			x															
AN18	B2			x															
AN18	B2			x															
AN18	B2			x															
AN18	B2	x																	
AN18	B2	x																	
AN18	B2	x																	
AN18	B2	x																	
AN18	B2		x																
AN18	B2					x					x								
AN18	B2			x															
AN18	B2			x															
AN18	B2											x							
AN18	B2											x							
AN18	B2											x							
AN18	B2															x			
AN18	B2															x			

AN18	B2					x													
AN18	B2					x													
AN18	B2											x							
AN18	B2											x							
AN18	B2											x							
AN18	B2	x																	
AN18	B2									x									
AN18	B2									x									
AN18	B2														x				
AN18	B2														x				
AN18	B2														x				
AN18	B2														x				
AN18	B2														x				
ME25	B2			x		x													
ME25	B2			x		x													
ME25	B2	x																	
ME25	B2													x					
ME25	B2					x													
ME25	B2	x										x							
ME25	B2											x							
ME25	B2			x		x													
ME25	B2									x									
ME25	B2						x												
ME25	B2								x										
ME25	B2											x							
ME25	B2			x		x													
ME25	B2						x												
VI01	B2			x															
VI01	B2																x		
VI01	B2	x																	
VI01	B2							x	x										

VI01	B2													x					
VI01	B2		x																
VI01	B2							x											
VI01	B2			x		x													
VI01	B2						x												
VI01	B2	x																	
VI01	B2									x				x					
VI01	B2											x							
VI01	B2									x									
VI01	B2													x					
VI01	B2													x					
VI01	B2													x					
VI01	B2					x													
VI01	B2													x					
MA12	B2							x											
MA12	B2											x							
MA12	B2	x																	
MA12	B2			x															
MA12	B2																x		
MA12	B2														x				
MA12	B2		x																
MA12	B2		x																
MA12	B2						x												
MA12	B2				x														
MA12	B2														x				
MA12	B2				x														
MA12	B2	x								x									
MA12	B2											x							
MA12	B2						x												
MA12	B2						x												
MA12	B2	x																	
MA12	B2								x										
KA02b	B2											x							
KA02b	B2																x		
KA02b	B2			x															
KA02b	B2	x																	

KA02b	B2										x								
KA02b	B2													x					
KA02b	B2																x		
KA02b	B2													x					
KA02b	B2											x							
KA02b	B2																x		
KA02b	B2													x					
KA02b	B2					x					x								
SA04b	B2											x							
SA04b	B2											x							
SA04b	B2											x							
SA04b	B2																x		
SA04b	B2		x											x					
SA04b	B2			x															
SA04b	B2							x	x										
SA04b	B2													x					
SA04b	B2								x										
SA04b	B2									x									
SA04b	B2					x													
SA04b	B2													x					
SA04b	B2							x						x					
SA04b	B2			x															
SA04b	B2										x								
JA04	B2	x																	
JA04	B2	x																	
JA04	B2	x																	
JA04	B2											x							
JA04	B2											x							
JA04	B2											x							
JA04	B2											x							
JA04	B2													x					
JA04	B2										x								
JA04	B2			x															
JA04	B2													x					
JA04	B2													x					

JA04	B2													x					
JA04	B2					x													
JA04	B2													x					
JA04	B2																x		
JA04	B2														x				
JA04	B2									x							x		
JA04	B2																x		

A2																			
ID	P-Code	Geometry	Kinematics	Forces	Energy	Material	Signals	Safety	Ergonomics	Production	Quality Control	Assembly	Transport	Operation	Maintenance	Recycling	Costs	Schedules	N/A
AN09	A2													x					
AN09	A2											x							
AN09	A2			x															
AN09	A2													x					
AN09	A2	x										x							
AN09	A2	x						x											
AN09	A2							x						x					
AN09	A2		x																
AN09	A2													x					
AN09	A2								x										
GI21	A2									x									
GI21	A2			x															
GI21	A2											x							
GI21	A2													x					
GI21	A2													x					
GI21	A2													x					
GI21	A2	x												x					
GI21	A2	x																	
GI21	A2	x												x					
GI21	A2											x							
GI21	A2													x					
GI21	A2							x											

GI 21	A2							x	x										
GI 21	A2														x				
GI 21	A2																x		
GI 21	A2										x								
GI 21	A2						x												
GI 21	A2											x							
GI 21	A2										x								
GI 21	A2													x					
CH 15	A2	x																	
CH 15	A2	x																	
CH 15	A2													x					
CH 15	A2													x					
CH 15	A2											x							
CH 15	A2													x					
CH 15	A2													x					
CH 15	A2			x															
CH 15	A2													x					
CH 15	A2													x					
CH 15	A2				x														
CH 15	A2				x			x											
CH 15	A2					x													
CH 15	A2							x	x										
CH 15	A2							x						x					
CH 15	A2							x											
CH 15	A2													x					
CH 15	A2																x		
CH 15	A2											x							
CH 15	A2	x											x						
CH 15	A2											x							
CH 15	A2								x										
CH 15	A2									x					x				
CH 15	A2															x			
CH 15	A2									x									
CH 15	A2									x									

SU 02	A2													x					
SU 02	A2													x					
SU 02	A2														x				
SU 02	A2			x										x					
SU 02	A2					x				x									
SU 02	A2													x					
SU 02	A2									x									
SU 02	A2															x			
SU 02	A2				x														
SU 02	A2												x						
SU 02	A2											x							
SU 02	A2	x												x					
SU 02	A2		x											x					
LO 01	A2							x											
LO 01	A2							x											
LO 01	A2													x					
LO 01	A2			x															
LO 01	A2			x															
LO 01	A2								x					x					
LO 01	A2	x																	
LO 01	A2										x			x					
LO 01	A2														x				
LO 01	A2			x															
LO 01	A2																x		
LO 01	A2											x							
LO 01	A2													x					
LO 01	A2													x					
LO 01	A2													x					
LO 01	A2								x										
LO 01	A2								x										
LO 01	A2											x							
LO 01	A2											x							
JU 02	A2													x					
JU 02	A2	x																	

JU 02	A2													x					
JU 02	A2											x		x					
JU 02	A2													x					
JU 02	A2													x					
JU 02	A2							x						x					
JU 02	A2	x												x					
JU 02	A2			x															
JU 02	A2														x				
JU 02	A2													x					
JU 02	A2													x					
JU 02	A2													x					
JU 02	A2													x					
LO 03	A2	x																	
LO 03	A2													x					
LO 03	A2													x					
LO 03	A2				x														
LO 03	A2							x											
LO 03	A2														x				
LO 03	A2											x							
LO 03	A2					x								x					
LO 03	A2																x		
LO 03	A2											x							
LO 03	A2													x					
A M 20	A2							x											
A M 20	A2	x																	
A M 20	A2							x	x										
A M 20	A2													x					
A M 20	A2											x		x					
A M 20	A2									x									
A M 20	A2							x						x					

MA19	A2									x									
MA19	A2													x					
MA19	A2	x												x					
MA19	A2			x															
MA19	A2								x										
MA19	A2								x										
MA19	A2							x											
MA19	A2							x	x										
MA19	A2							x	x										
MA19	A2													x					
MA19	A2													x					
MA19	A2										x								
MA19	A2			x															
MA19	A2								x										
MA19	A2											x							
MA19	A2											x							
MA19	A2									x									
MA19	A2														x				
MA19	A2														x				
MA19	A2										x								
MA19	A2																x		
MA19	A2													x					
MA19	A2														x				

MA19	A2														x				
MA19	A2														x				
MA19	A2															x			
SA11	A2							x											
SA11	A2																		x
SA11	A2	x																	
SA11	A2							x	x										
SA11	A2											x							
SA11	A2	x																	
SA11	A2													x					
SA11	A2													x					
SA11	A2									x									
SA11	A2																x		
SA11	A2												x						
SA11	A2												x						
SA11	A2													x					
SA11	A2								x										
SA11	A2														x				
SA11	A2														x				
SA11	A2											x							
SA11	A2			x															
SA11	A2			x		x									x				
SA11	A2													x					
SA11	A2															x			
JE06	A2							x											
JE06	A2							x	x										
JE06	A2							x	x										
JE06	A2													x					
JE06	A2													x					
JE06	A2													x					
JE06	A2													x					
JE06	A2	x												x					
JE06	A2													x					

JE 06	A2													x					
JE 06	A2		x																
JE 06	A2			x															
JE 06	A2											x							
JE 06	A2											x							
JE 06	A2											x							
JE 06	A2													x					
JE 06	A2													x					
JE 06	A2													x					
JE 06	A2											x							
JE 06	A2													x					
JE 06	A2			x										x					
JE 10	A2							x											
JE 10	A2			x															
JE 10	A2	x																	
JE 10	A2													x					
JE 10	A2			x										x					
JE 10	A2													x					
JE 10	A2													x					
JE 10	A2	x												x					
JE 10	A2													x					
JE 10	A2									x		x							
JE 10	A2													x					
JE 10	A2											x							
JE 10	A2													x					
JE 10	A2													x					
JE 10	A2								x										
JE 10	A2										x				x				
JE 10	A2																x		
JE 10	A2													x					
JE 10	A2													x					
JE 10	A2													x					
JE 10	A2													x					
JE 10	A2														x				

JE 10	A2													x					
TA 06	A2							x											
TA 06	A2																		x
TA 06	A2													x					
TA 06	A2				x														
TA 06	A2			x															
TA 06	A2						x												
TA 06	A2													x					
TA 06	A2										x								
TA 06	A2													x					
TA 06	A2		x											x					
TA 06	A2								x										
TA 06	A2																x		
TA 06	A2	x																	
TA 06	A2	x		x															
TA 06	A2														x				
TA 06	A2						x												
TA 06	A2				x			x											
TA 06	A2			x															
TA 06	A2			x															
TA 06	A2													x					
TA 06	A2							x											
TA 06	A2									x									
TA 06	A2										x								
BR 02	A2			x															
BR 02	A2							x	x										
BR 02	A2	x												x					
BR 02	A2											x							
BR 02	A2			x															
A N1 1	A2									x				x					
A N1 1	A2							x											
A N1 1	A2																		x

AN11	A2													x					
AN11	A2			x															
AN11	A2													x					
AN11	A2											x							
AN11	A2													x					
AN11	A2			x															
AN11	A2	x																	
KA05	A2							x											
KA05	A2																		x
KA05	A2	x												x					
KA05	A2													x					
KA05	A2	x																	
KA05	A2	x								x									
KA05	A2											x							
KA05	A2													x					
KA05	A2														x				
CI26	A2	x																	
CI26	A2							x											
CI26	A2							x	x										
CI26	A2		x											x					
CI26	A2																		x
CI26	A2			x															
CI26	A2													x					
CI26	A2													x					
CI26	A2			x															
CI26	A2								x										
CI26	A2			x															
CI26	A2											x							
CI26	A2													x					
CI26	A2													x					
CI26	A2											x							

CI 26	A2				x														
CI 26	A2												x						
LY 04	A2							x											
LY 04	A2													x					
LY 04	A2			x										x					
LY 04	A2	x												x					
LY 04	A2												x						
LY 04	A2													x					
LY 04	A2									x									
LY 04	A2			x										x					
LY 04	A2				x														
LY 04	A2																x		
LY 04	A2														x				
LY 04	A2											x							
LY 04	A2													x					
LY 04	A2													x					
LY 04	A2																	x	
LY 04	A2									x		x							
JE 17	A2			x		x													
JE 17	A2			x															
JE 17	A2													x					
JE 17	A2													x					
JE 17	A2							x											
JE 17	A2											x							
JE 17	A2														x				
JE 17	A2																x		
JE 17	A2					x			x										
JE 17	A2										x								
JE 17	A2			x															
JE 17	A2													x					
JE 17	A2																x		
JE 17	A2				x														
JE 17	A2						x												
JE 17	A2									x									

SA06	A2													x					
SA06	A2	x																	
SA06	A2							x											
SA06	A2							x						x					
SA06	A2													x					
SA06	A2			x										x					
SA06	A2													x					
SA06	A2									x									
SA06	A2													x					
SA06	A2													x					
SA06	A2											x							
SA06	A2													x					
SA06	A2														x				
SA06	A2																x		
SA06	A2													x					
SA06	A2													x					
SA06	A2													x					
MA02	A2													x					
MA02	A2													x					
MA02	A2													x					
MA02	A2									x									
MA02	A2	x																	
MA02	A2													x					
MA02	A2		x											x					
MA02	A2			x		x													
MA02	A2									x		x							
MA02	A2													x					
MA02	A2									x							x		

MA02	A2													x	x				
MA02	A2			x															
MA02	A2											x							
MA02	A2				x														
MA02	A2	x												x					
MA02	A2						x	x						x					
MA02	A2													x					
CA11	A2	x																	
CA11	A2	x																	
CA11	A2	x																	
CA11	A2		x																
CA11	A2		x																
CA11	A2			x															
CA11	A2											x							
CA11	A2													x					
CA11	A2													x					
CA11	A2													x					
MA01a	A2	x												x					
MA01a	A2							x											
MA01a	A2													x					
MA01a	A2													x					
MA01a	A2													x					
MA01a	A2													x					
MA01a	A2									x									
JO04	A2											x							
JO04	A2														x				
JO04	A2																x		

JO 04	A2	x												x					
JO 04	A2													x					
JO 04	A2													x					
JO 04	A2													x					
JO 04	A2													x					
JO 04	A2									x									
JO 04	A2														x				
JO 04	A2											x							
JO 04	A2													x					
JO 04	A2					x		x			x								
JO 04	A2							x	x										
JO 04	A2													x					
JO 04	A2												x						
JO 04	A2													x					
JO 04	A2												x	x					
JO 04	A2	x																	
JO 04	A2															x			
JO 04	A2							x											
JO 04	A2								x										
JO 04	A2													x					
JO 04	A2												x	x					
LA 07	A2													x					
LA 07	A2											x							
LA 07	A2			x															
LA 07	A2											x							
LA 07	A2	x												x					
LA 07	A2	x												x					
LA 07	A2				x														
LA 07	A2			x															
LA 07	A2	x																	
LA 07	A2														x				
LA 07	A2								x										
LA 07	A2													x					
LA 07	A2				x														

LA 07	A2														x				
LA 07	A2													x					
LA 07	A2					x													
LA 07	A2																x		
MI 16	A2													x					
MI 16	A2													x					
MI 16	A2							x	x										
MI 16	A2			x															
MI 16	A2													x					
MI 16	A2													x					
MI 16	A2	x												x					
MI 16	A2											x							
MI 16	A2				x														
MI 16	A2																x		
MI 16	A2													x					
MI 16	A2			x															
MI 16	A2	x																	
MI 16	A2											x							
MI 16	A2		x																
MI 16	A2		x					x											
MI 16	A2								x										
MI 16	A2			x		x													
CH 02	A2													x					
CH 02	A2													x					
CH 02	A2											x							
CH 02	A2			x															
CH 02	A2							x											
CH 02	A2		x	x										x					
CH 02	A2											x							
CH 02	A2																x		
CH 02	A2														x				
CH 02	A2								x										
CH 02	A2						x												
CH 02	A2													x					

LI14	A2							x						x					
LI14	A2													x					
LI14	A2	x																	
LI14	A2													x					
LI14	A2													x					
LI14	A2	x												x					
LI14	A2			x															
LI14	A2											x							
LI14	A2													x					
LI14	A2							x	x										
LI14	A2				x														
LI14	A2											x							
LI14	A2			x															
CH11	A2	x												x					
CH11	A2							x											
CH11	A2													x					
CH11	A2													x					
CH11	A2									x		x							
CH11	A2		x											x					
CH11	A2			x															
CH11	A2														x				
CH11	A2											x							
CH11	A2									x							x		
TE30	A2	x												x					
TE30	A2													x					
TE30	A2													x					
TE30	A2							x	x										
TE30	A2														x				
TE30	A2	x																	
TE30	A2													x					
TE30	A2													x					
TE30	A2													x					
TE30	A2			x															
TE30	A2								x										

TE30	A2													x					
TE30	A2													x					
MA01b	A2													x					
MA01b	A2											x							
MA01b	A2													x					
MA01b	A2										x			x					
MA01b	A2												x						
MA01b	A2											x							
MA01b	A2			x										x					
MA01b	A2													x					
MA01b	A2																x		
MA01b	A2													x					
MA01b	A2													x					
MA01b	A2						x	x											
BA23	A2									x									
BA23	A2													x					
BA23	A2													x					
BA23	A2												x						
BA23	A2			x															
BA23	A2													x					
BA23	A2						x							x					
BA23	A2							x	x										
BA23	A2													x					
BA23	A2												x						
BA23	A2											x		x					
BA23	A2														x				
BA23	A2												x						
BA23	A2																x		

BA 23	A2			x															
KA 19	A2													x					
KA 19	A2									x									
KA 19	A2									x							x		
KA 19	A2									x									
KA 19	A2			x										x					
KA 19	A2							x											
KA 19	A2			x		x													
KA 19	A2														x				
KA 19	A2											x							
KA 19	A2													x					
KA 19	A2													x					
KA 19	A2								x										
KA 19	A2																		x
KA 19	A2									x									
KA 19	A2											x							
KA 19	A2												x						
KA 19	A2												x						
KA 19	A2														x				
KA 19	A2					x											x		
KA 19	A2					x		x											
KA 19	A2															x			
KA 19	A2	x																	
KA 19	A2								x										
TA 18	A2											x							
TA 18	A2													x					
TA 18	A2													x					
TA 18	A2													x					
TA 18	A2					x													
TA 18	A2	x																	
TA 18	A2													x					
TA 18	A2													x					
TA 18	A2																x		
TA 18	A2						x												

TA 18	A2							x	x										
TA 18	A2													x					
TA 18	A2														x				
TA 18	A2								x										
DE 09	A2	x												x					
DE 09	A2							x											
DE 09	A2													x					
DE 09	A2													x					
DE 09	A2													x					
DE 09	A2											x							
DE 09	A2													x					
DE 09	A2																x		
DE 09	A2														x				
DE 09	A2												x						
DE 09	A2				x														
DE 09	A2									x									
KA 09	A2							x	x										
KA 09	A2								x										
KA 09	A2											x							
KA 09	A2			x															
KA 09	A2	x												x					
KA 09	A2		x											x					
KA 09	A2								x										
KA 09	A2	x																	
KA 09	A2																x		
KA 09	A2													x					
KA 09	A2					x											x		
KA 09	A2								x										
KA 09	A2													x	x				
PE 06	A2													x					
PE 06	A2																	x	
PE 06	A2													x					
PE 06	A2													x					
AS 17	A2													x					

AS 17	A2	x																	
AS 17	A2													x					
AS 17	A2													x					
AS 17	A2													x					
AS 17	A2													x					
AS 17	A2													x					
AS 17	A2													x					
AS 17	A2														x				
RO 02	A2	x																	
RO 02	A2											x							
RO 02	A2											x							
RO 02	A2											x							
RO 02	A2													x					
RO 02	A2													x					
RO 02	A2													x					
RO 02	A2			x										x					
TO 09	A2	x										x							
TO 09	A2													x					
TO 09	A2			x															
TO 09	A2			x										x					
TO 09	A2													x					
TO 09	A2														x				
TO 09	A2																x		
TO 09	A2											x							
TO 09	A2											x							
TO 09	A2													x					
TO 09	A2									x					x				
TO 09	A2														x				
TO 09	A2				x														
TO 09	A2													x					
TO 09	A2													x					
SO 07	A2			x					x										
SO 07	A2			x															
SO 07	A2	x												x					

SO 07	A2													x					
SO 07	A2													x					
SO 07	A2											x							
SO 07	A2		x						x					x					
SO 07	A2		x											x					
SO 07	A2													x					
SO 07	A2																x		
SO 07	A2						x							x					
SO 07	A2														x				
SO 07	A2												x						
BH 15	A2									x									
BH 15	A2							x											
BH 15	A2		x											x					
BH 15	A2											x							
BH 15	A2											x							
BH 15	A2		x																
BH 15	A2													x					
BH 15	A2													x					
BH 15	A2													x					
BH 15	A2		x											x					
BH 15	A2	x												x					
BH 15	A2											x							
BH 15	A2													x					
BH 15	A2														x				
BH 15	A2				x														
BH 15	A2	x																	
BH 15	A2	x																	
BH 15	A2									x		x							
BH 15	A2									x		x							
CA 21	A2	x																	
CA 21	A2																x		
CA 21	A2													x					
CA 21	A2													x					
CA 21	A2														x				

CA 21	A2								x					x					
CA 21	A2											x							
CA 21	A2											x							
CA 21	A2													x					
CA 21	A2			x															
CA 21	A2														x				
CA 21	A2														x				
CA 21	A2															x			
CA 21	A2										x								
CA 21	A2			x															
CA 21	A2	x																	
CA 21	A2													x					
CA 21	A2								x										
CA 21	A2											x							
CA 21	A2											x							
CA 21	A2													x					
KI 10	A2										x								
KI 10	A2													x					
KI 10	A2													x					
KI 10	A2													x					
KI 10	A2											x							
KI 10	A2	x												x					
KI 10	A2			x															
KI 10	A2																x		
KI 10	A2													x					
KI 10	A2			x								x							
KI 10	A2					x													
KI 10	A2														x				
KI 10	A2	x																	
KI 10	A2													x					
KI 10	A2											x	x						
KI 10	A2											x							
JO 26	A2													x					
JO 26	A2													x					

JO 26	A2													x					
JO 26	A2													x					
JO 26	A2									x		x							
JO 26	A2			x															
JO 26	A2	x												x					
JO 26	A2													x					
JO 26	A2													x					
JO 26	A2																x		
JO 26	A2													x					
KA 10 b	A2	x												x					
KA 10 b	A2													x					
KA 10 b	A2											x							
KA 10 b	A2				x														
KA 10 b	A2				x														
KA 10 b	A2			x		x													
KA 10 b	A2									x									
KA 10 b	A2									x									
KA 10 b	A2	x											x						
KA 10 b	A2															x			
KA 10 b	A2																x		
KA 10 b	A2									x									
DA 19	A2									x									
DA 19	A2													x					
DA 19	A2			x															
DA 19	A2											x							
DA 19	A2													x					
DA 19	A2														x				
DA 19	A2	x																	

DA 19	A2							x											
DA 19	A2	x												x					
DA 19	A2								x										
DA 19	A2		x											x					
LI0 9	A2													x					
LI0 9	A2								x										
LI0 9	A2			x										x					
LI0 9	A2												x						
LI0 9	A2									x									
LI0 9	A2													x					
LI0 9	A2													x					
LI0 9	A2							x											
LI0 9	A2				x														
LI0 9	A2			x		x											x		
LI0 9	A2													x					
LI0 9	A2			x															
LI0 9	A2													x					
CH 21	A2	x												x					
CH 21	A2											x							
CH 21	A2													x					
CH 21	A2									x							x		
CH 21	A2	x												x					
CH 21	A2													x					
CH 21	A2								x										
CH 21	A2							x	x										
CH 21	A2											x							
CH 21	A2			x															
CH 21	A2				x														
CH 21	A2													x					
CH 21	A2					x													
SU 11 A	A2			x															
SU 11 A	A2													x					
SU 11 A	A2													x					

SU 11 A	A2	x												x					
SU 11 A	A2																x		
JO 04 b	A2							x											
JO 04 b	A2																		x
JO 04 b	A2													x					
JO 04 b	A2													x					
JO 04 b	A2	x												x					
JO 04 b	A2											x							
JO 04 b	A2													x					
JO 04 b	A2													x					
JO 04 b	A2			x															
JO 04 b	A2	x																	
JO 04 b	A2											x							
JO 04 b	A2													x					
JO 04 b	A2																x		
JO 04 b	A2			x										x					
JO 04 b	A2													x					
JO 04 b	A2														x				

Appendix F. Novelty Results

B1	
SUM	Count if less than 0.6
43.6	1
43.43	1
44.36	1
44.93	0
44.47	0
43.57	0
43.17	1
43.91	1
43.74	0
41.78	5
45	0
34.98	6
43.78	1
39.67	5
41.08	0
40.43	0
31.49	25
44.06	0
44.59	1
42.18	0
45.02	0
40.93	5
41.82	1
43.23	0
43.1	1
34.98	6
44.78	0
43.84	0
43.84	0
43.35	0
42.59	0
43.51	1
37.82	4
44.22	0
43.65	1
40.85	1
42.2	0
39.78	5
41.42	0
42.55	1
43.47	1
44.63	0
44.12	1
44.56	0
43.13	1
34.98	6
43.33	1
44.91	0
39.77	0
34.98	6
42.88	0

A1	
SUM	Count if less than 0.6
60.35	0
61.45	0
61.8	0
61	0
61.59	0
62.39	0
61.9	0
61.99	0
58.36	0
61.44	0
59.89	0
59.97	0
59.16	0
59.87	0
59.28	0
60.71	0
55.15	7
61.1	0
61.18	0
61.88	0
59.95	0
60.44	0
54	0
49.11	5
61.46	0
61.7	0
61.2	0
61.19	0
49.11	5
62.43	0
54.29	7
61.75	0
59.98	0
59.58	7
60.47	0
55.47	7
58.23	0
61.29	0
60.24	0
60.65	0
49.11	5
61.76	0
62.54	0
61.54	0
60.19	0
60.76	0
60.62	0
58.44	0
61.89	0
60.15	0
59.93	0
59.73	0
61.05	0
60	0
60.26	0

49.11	5
61.49	0
61.91	0
61.19	0
55.9	7
49.11	5
59.55	0
61.21	0
61.87	0
49.11	5
61.22	0
49.11	5
61.72	0
56.75	0

B2	
SUM	Count if less than 0.6
61.86	0
60.71	0
60.85	0
61.88	0
61.81	0
59.64	0
61.65	0
52.47	3
60.64	0
52.47	3
60.32	0
52.47	3
52.47	3
55.89	15
59.5	0
60.37	0
56.76	15
59.6	0
60.61	0
59.87	0
58.66	0
52.47	3
60.94	0
59.4	0
52.47	3
52.47	3
59.29	0
60.3	0
52.47	3
60.88	0
60.16	0
59.92	0
61.35	0
58.32	0
52.47	3
52.47	3
59.2	0
52.47	3
61.24	0
60.68	0

57.93	0
60.49	0
60.38	0
60.76	0
60.6	0
61.16	0
60.74	0
61.05	0
52.47	3
60.06	0
52.47	3
57.9	0
60.86	0
60.32	0
61.04	0
61.04	0
61.27	0
58.89	0
60.48	0
60.89	0
60.93	0
52.47	3
58.65	0
57.86	0
53.25	15
62.09	0
60.78	0
52.47	3
60.47	0
56.74	0

A2	
SUM	Count if less than 0.6
44.29	0
44.22	0
44.79	0
41.14	0
44.7	0
44.82	0
39.67	1
44.61	0
44.52	0
44.58	0
39.67	1
39.67	1
44.02	0
43.31	0
42.57	0
42.7	0
43.67	0
39.67	1
44.2	0
39.67	1
44.89	0
43.13	0
42.68	0
43.88	0
43.09	0

39.67	1
44.44	0
39.67	1
42.36	0
44.49	0
39.67	1
44.09	0
39.39	13
39.67	1
43.02	0
39.67	1
40.37	0
43.47	0
42.71	0
43.35	0
44.01	0
43.84	0
44.21	0
42.84	0
42.02	0
39.67	1
43.73	0
44.75	0
43.59	0
39.67	1
39.67	1

Appendix G. Practitioner Raw List of Requirements

Practitioner Population 1		
Number	ID	Requirement
1	A	Device must be able to be operated safely with no injury to operator or others
2	A	Device must be able to be easily operated with minimal instruction
3	A	Device must not come damage to books
4	A	Device must be able to be retrofitted easily to a typical bookshelf
5	A	Device must be able to be operated from a seated position
6	A	Device must be able to retrieve books from at least 6 ft off the ground
7	A	Device must be of suitable weight and construction that it can be safely installed and operated on typical bookshelf
8	A	Device should have the ability to be either mechanically operated with minimal effort or electrically operated from left mains power battery supply
9	A	Device must be able to retrieve a single book without noticeable distance of adjacent books
1	B	The device shall attach to the bookshelves, with no attachment to the wheelchairs
2	B	When not in use, the device must not inhibit access to the books (in the case of non-wheelchair people)
3	B	The device must have safety interlocks to stop all motion when an arm/hand/finger comes within its "work cell"
4	B	The device can be gear or pneumatically actuated, but not hydraulically actuated, so as to avoid fluid spills
5	B	The device must operate on ROVAC, ISA or less, and include it own lockable breaker, local to the device
6	B	The device will be operated via wired pendant station
1	C	Neet to know maximum size and weight of books
2	C	Maximum height or length of travel for mechanism
3	C	Speed of lift and decel time to reach each shelf
4	C	Will there be sensord at each level for slowdown and stop
5	C	Cost to be under? Determines type of motor control (UFD, SEMO, etc)
6	C	Max weight of mechanism bookshelf can hold
7	C	Mechanism should have torque or safety sensors to prevent injury to personnel
8	C	Controls to be pushbutton ot app based
9	C	Motor to be 130 VAC
10	C	Timing belt for drive (quieter) or screw
11	C	Guards required on moving parts
1	D	Provide/ manufacture device with safe/readily available materials
2	D	Device would likely be some type of extended arm
3	D	Device should be non electrically/mechanically operated (clamp)
4	D	Consider size, shape, and weight of books in library
5	D	Arm should be mounted on bookshelf and move freely to allow access to entire bookshelf
6	D	Consider pulleys and levers
1	E	Handicap access is required if in public facility
2	E	Safety considerations of people is of most importance because of falling books
3	E	Required an articulating automated arm
4	E	Caliper pads on mechanical "hand" use position sensing
5	E	Mount on rail system that allows vertical and horizontal motion
6	E	Consider servo type mechanism with fine adjustment
7	E	Operation performed by hand held tablet with wireless communication
8	E	For library system utilize computer electronic lookup for dewey decimal system
1	F	Self-contained and/or rechargeable power supply
2	F	Vacuum instead of mechanical grab
3	F	If vacuum, then blower would need to be muffled for noise issues
4	F	Interconnecting series of chutes/slides to pass books to lower level, but not in the way of placement
5	F	Waist-high controls: shelf selection, left/right job buttons
6	F	Slides move into place only once book is chosen
7	F	Camera at end of grab mechanism with display screen at control panel
8	F	Buzzer for librarian
9	F	lift chairs

Practitioner Population 2		
Number	ID	Requirement
1	A	Interchangeable or wide range grippers
2	A	Minimize operation noise
3	A	Should be removable without creating damage to shelf
4	A	Battery or electricity from wall powered
5	A	Adjustable Height
6	A	Soft touch gripper for books
7	A	Sturdy/safe mount system
8	A	Light weight arm mechanism
1	B	Obtain a scope of work, number of shelves, legth of shelf, depth, height and number
2	B	Geometric sizes of the books and weight
3	B	Distance between aisles fo shelves is there room for a wheel chair
1	C	Reach height
2	C	Book max thickness
3	C	Book max weight
4	C	Available utilities (electric, pneumatics)
5	C	Speed Required - How many transactions per hour
6	C	Width of shelves
7	C	Human strength required (grip, lift, etc)
1	D	Mechanism must not interfere with aisle why in existing layout, must not inhibit wheelchair access
2	D	System should have a safety mechanism guarding, or provisions to prevent dropping of books (book being picked up or books around it)
3	D	Design should mount to existing book case designs
4	D	Standard shelf thickness
5	D	Design should allor "operator" in wheelchair to easily view the back of the books on the shelf while sitting in the wheelchair
6	D	Mechanism must be able to grab book thicknesses from 1/4" to 2" wide
7	D	Design must be modular

Appendix H. Practitioner Quantity Requirement Count

Practitioner Population Combined Count			
Participants	Count 1	Count 2	Count 3
A	11	9	9
B	6	6	6
C	11	11	11
D	6	6	6
E	8	8	8
F	9	9	9
A	8	8	8
B	3	7	7
C	7	7	7
D	6	7	7
SUM	75	78	78
AVG	7.5	7.8	7.8

Appendix I. Functional and Non-Functional Data Results

ID	P-Code	NF	F	N/A
AN09	B1	0	1	0
AN09	B1	0	0	1
AN09	B1	0	0	1
AN09	B1	1	0	0
AN09	B1	0	1	0
AN09	B1	0	1	0
AN09	B1	0	0	1
AN09	B1	0	0	1
AN09	B1	0	1	0
GI21	B1	1	0	0
GI21	B1	0	0	1
GI21	B1	0	0	1
GI21	B1	0	1	0
GI21	B1	0	0	1
GI21	B1	0	1	0
GI21	B1	0	0	1
GI21	B1	0	1	0
CH15	B1	0	1	0
CH15	B1	0	1	0
CH15	B1	1	0	0
CH15	B1	0	1	0
CH15	B1	0	1	0
CH15	B1	0	1	0
CH15	B1	1	0	0
CH15	B1	0	1	0
CH15	B1	1	0	0
CH15	B1	0	1	0
CH15	B1	0	0	1
CH15	B1	0	1	0
SU02	B1	0	1	0
SU02	B1	0	1	0
SU02	B1	0	1	0
SU02	B1	1	0	0
SU02	B1	0	1	0
SU02	B1	1	0	0
SU02	B1	1	0	0
SU02	B1	0	1	0
SU02	B1	1	0	0
LO01	B1	0	0	1
LO01	B1	0	0	1
LO01	B1	0	0	1
LO01	B1	0	0	1
LO01	B1	0	1	0
LO01	B1	1	0	0
LO01	B1	0	1	0
LO01	B1	0	1	0
LO01	B1	0	0	1
LO01	B1	0	1	0
LO01	B1	1	0	0
LO01	B1	0	1	0
LO01	B1	0	1	0
LO01	B1	1	0	0
LO01	B1	1	0	0
LO01	B1	0	1	0
LO01	B1	1	0	0
LO01	B1	1	0	0
JU02	B1	0	0	1
JU02	B1	1	0	0
JU02	B1	0	0	1
JU02	B1	0	1	0
JU02	B1	0	0	1
JU02	B1	0	1	0
JU02	B1	0	1	0
LO03	B1	1	0	0
LO03	B1	0	1	0
LO03	B1	1	0	0

LO03	B1	0	1	0
LO03	B1	0	1	0
LO03	B1	1	0	0
LO03	B1	1	0	0
LO03	B1	0	1	0
AM20	B1	0	0	1
AM20	B1	0	0	1
AM20	B1	0	0	1
AM20	B1	1	0	0
AM20	B1	1	0	0
AM20	B1	0	0	1
AM20	B1	1	0	0
AM20	B1	1	0	0
AM20	B1	1	0	0
MA19	B1	1	0	0
MA19	B1	0	0	1
MA19	B1	0	0	1
MA19	B1	0	0	1
MA19	B1	0	0	1
MA19	B1	0	0	1
MA19	B1	0	1	0
MA19	B1	0	0	1
MA19	B1	0	1	0
MA19	B1	0	1	0
MA19	B1	0	1	0
MA19	B1	1	0	0
MA19	B1	0	1	0
MA19	B1	0	0	1
MA19	B1	0	0	1
MA19	B1	0	1	0
MA19	B1	0	1	0
MA19	B1	0	0	1
MA19	B1	0	1	0
MA19	B1	0	0	1
MA19	B1	0	1	0
SA11	B1	0	1	0
SA11	B1	0	0	1
SA11	B1	0	0	1
SA11	B1	0	1	0
SA11	B1	0	0	1
SA11	B1	0	0	1
SA11	B1	0	0	1
SA11	B1	0	1	0
SA11	B1	0	0	1
JE06	B1	0	1	0
JE06	B1	1	0	0
JE06	B1	0	1	0
JE06	B1	1	0	0
JE06	B1	0	0	1
JE06	B1	0	0	1
JE06	B1	0	0	1
JE06	B1	0	1	0
JE06	B1	0	1	0
JE06	B1	0	1	0
JE06	B1	1	0	0
JE06	B1	0	1	0
JE06	B1	0	1	0
JE06	B1	0	1	0
JE06	B1	0	0	1

JE06	B1	0	1	0
JE06	B1	0	1	0
JE10	B1	1	0	0
JE10	B1	1	0	0
JE10	B1	1	0	0
JE10	B1	1	0	0
JE10	B1	0	1	0
JE10	B1	1	0	0
JE10	B1	0	1	0
JE10	B1	1	0	0
JE10	B1	1	0	0
JE10	B1	1	0	0
JE10	B1	1	0	0
JE10	B1	1	0	0
JE10	B1	1	0	0
JE10	B1	0	1	0
JE10	B1	0	1	0
JE10	B1	1	0	0
TA06	B1	1	0	0
TA06	B1	0	1	0
TA06	B1	0	1	0
TA06	B1	1	0	0
TA06	B1	1	0	0
TA06	B1	1	0	0
TA06	B1	1	0	0
TA06	B1	0	1	0
TA06	B1	1	0	0
TA06	B1	0	1	0
TA06	B1	0	1	0
TA06	B1	1	0	0
TA06	B1	1	0	0
TA06	B1	0	1	0
TA06	B1	0	1	0
BR02	B1	1	0	0
BR02	B1	0	1	0
BR02	B1	0	1	0
BR02	B1	0	1	0
AN11	B1	0	0	1
AN11	B1	0	0	1
AN11	B1	0	1	0
AN11	B1	0	1	0
AN11	B1	0	0	1
AN11	B1	0	0	1
AN11	B1	1	0	0
KA05	B1	0	1	0
KA05	B1	0	0	1
KA05	B1	0	0	1
KA05	B1	0	0	1
KA05	B1	0	1	0
KA05	B1	0	0	1
KA05	B1	0	0	1
KA05	B1	1	0	0
CI26	B1	0	0	1
CI26	B1	0	1	0
CI26	B1	0	0	1
CI26	B1	0	0	1
CI26	B1	0	0	1
CI26	B1	0	0	1
CI26	B1	0	0	1

CI26	B1	0	0	1
LY04	B1	0	1	0
LY04	B1	0	1	0
LY04	B1	1	0	0
LY04	B1	0	1	0
LY04	B1	0	0	1
LY04	B1	0	0	1
LY04	B1	0	1	0
LY04	B1	0	1	0
LY04	B1	1	0	0
LY04	B1	0	1	0
LY04	B1	1	0	0
JE17	B1	0	1	0
JE17	B1	1	0	0
JE17	B1	1	0	0
JE17	B1	1	0	0
JE17	B1	1	0	0
JE17	B1	1	0	0
JE17	B1	1	0	0
JE17	B1	1	0	0
JE17	B1	0	1	0
SA06	B1	0	1	0
SA06	B1	0	1	0
SA06	B1	1	0	0
SA06	B1	1	0	0
SA06	B1	0	0	1
SA06	B1	0	0	1
MA02	B1	0	1	0
MA02	B1	1	0	0
MA02	B1	1	0	0
MA02	B1	1	0	0
MA02	B1	1	0	0
MA02	B1	1	0	0
MA02	B1	1	0	0
MA02	B1	1	0	0
MA02	B1	1	0	0
MA02	B1	1	0	0
MA02	B1	0	1	0
MA02	B1	1	0	0
MA02	B1	0	1	0
CA11	B1	0	1	0
CA11	B1	1	0	0
CA11	B1	0	0	1
CA11	B1	1	0	0
CA11	B1	1	0	0
CA11	B1	0	0	1
CA11	B1	0	0	1
MA01a	B1	1	0	0
MA01a	B1	0	1	0
MA01a	B1	0	1	0
MA01a	B1	0	1	0
JO04	B1	0	0	1
JO04	B1	0	1	0
JO04	B1	0	1	0
JO04	B1	0	1	0
JO04	B1	0	1	0
JO04	B1	1	0	0
JO04	B1	1	0	0
JO04	B1	0	1	0

JO04	B1	1	0	0
JO04	B1	0	1	0
LA07	B1	1	0	0
LA07	B1	1	0	0
LA07	B1	1	0	0
LA07	B1	0	1	0
LA07	B1	1	0	0
LA07	B1	1	0	0
LA07	B1	0	1	0
MI16	B1	0	1	0
MI16	B1	0	1	0
MI16	B1	0	1	0
MI16	B1	1	0	0
MI16	B1	0	1	0
MI16	B1	1	0	0
MI16	B1	0	1	0
MI16	B1	0	1	0
CH02	B1	1	0	0
CH02	B1	0	1	0
CH02	B1	1	0	0
CH02	B1	0	1	0
CH02	B1	0	1	0
CH02	B1	1	0	0
LI14	B1	1	0	0
LI14	B1	0	1	0
LI14	B1	1	0	0
LI14	B1	0	1	0
LI14	B1	1	0	0
LI14	B1	1	0	0
CH11	B1	1	0	0
CH11	B1	1	0	0
CH11	B1	0	0	1
CH11	B1	0	1	0
CH11	B1	0	1	0
CH11	B1	0	0	1
CH11	B1	0	0	1
CH11	B1	0	1	0
CH11	B1	1	0	0
CH11	B1	1	0	0
CH11	B1	0	1	0
TE30	B1	0	0	1
TE30	B1	0	0	1
TE30	B1	1	0	0
TE30	B1	0	0	1
TE30	B1	0	0	1
TE30	B1	1	0	0
TE30	B1	0	0	1
TE30	B1	0	0	1
TE30	B1	0	1	0
TE30	B1	0	1	0
TE30	B1	0	0	1
MA01b	B1	0	0	1
MA01b	B1	1	0	0
MA01b	B1	1	0	0
MA01b	B1	1	0	0
MA01b	B1	1	0	0
MA01b	B1	1	0	0
MA01b	B1	0	1	0
BA23	B1	1	0	0

BA23	B1	0	1	0
BA23	B1	1	0	0
BA23	B1	0	1	0
BA23	B1	0	1	0
BA23	B1	1	0	0
BA23	B1	1	0	0
BA23	B1	1	0	0
BA23	B1	1	0	0
BA23	B1	1	0	0
BA23	B1	0	1	0
KA19	B1	0	1	0
KA19	B1	0	0	1
KA19	B1	0	0	1
KA19	B1	0	0	1
KA19	B1	0	0	1
KA19	B1	0	0	1
KA19	B1	0	0	1
KA19	B1	0	0	1
KA19	B1	0	0	1
TA18	B1	0	1	0
TA18	B1	1	0	0
TA18	B1	0	1	0
TA18	B1	0	1	0
TA18	B1	1	0	0
TA18	B1	1	0	0
TA18	B1	1	0	0
TA18	B1	0	1	0
TA18	B1	0	1	0
TA18	B1	0	1	0
TA18	B1	0	1	0
DE09	B1	0	1	0
DE09	B1	0	1	0
DE09	B1	0	1	0
DE09	B1	1	0	0
DE09	B1	0	1	0
DE09	B1	0	1	0
DE09	B1	1	0	0
KA09	B1	0	1	0
KA09	B1	0	1	0
KA09	B1	0	1	0
KA09	B1	0	1	0
PE06	B1	0	0	1
PE06	B1	0	0	1
PE06	B1	0	0	1
PE06	B1	0	0	1
PE06	B1	0	1	0
PE06	B1	0	0	1
PE06	B1	1	0	0
PE06	B1	1	0	0
PE06	B1	0	0	1
PE06	B1	0	0	1
PE06	B1	0	0	1
PE06	B1	0	0	1
PE06	B1	0	0	1
AS17	B1	0	1	0
AS17	B1	0	1	0
AS17	B1	0	0	1
AS17	B1	0	0	1
AS17	B1	0	0	1

AS17	B1	0	0	1
AS17	B1	0	0	1
AS17	B1	0	0	1
AS17	B1	0	1	0
RO02	B1	1	0	0
RO02	B1	1	0	0
RO02	B1	1	0	0
RO02	B1	1	0	0
RO02	B1	0	1	0
RO02	B1	1	0	0
TO09	B1	1	0	0
TO09	B1	1	0	0
TO09	B1	1	0	0
TO09	B1	1	0	0
TO09	B1	1	0	0
TO09	B1	1	0	0
TO09	B1	1	0	0
TO09	B1	1	0	0
TO09	B1	0	1	0
SO07	B1	1	0	0
SO07	B1	1	0	0
SO07	B1	1	0	0
SO07	B1	1	0	0
SO07	B1	1	0	0
SO07	B1	1	0	0
SO07	B1	0	1	0
SO07	B1	0	1	0
BH15	B1	0	1	0
BH15	B1	1	0	0
BH15	B1	1	0	0
BH15	B1	1	0	0
BH15	B1	0	0	1
BH15	B1	0	0	1
BH15	B1	0	0	1
BH15	B1	0	0	1
BH15	B1	0	0	1
BH15	B1	0	1	0
BH15	B1	1	0	0
BH15	B1	0	0	1
BH15	B1	0	0	1
BH15	B1	0	0	1
BH15	B1	0	1	0
BH15	B1	1	0	0
BH15	B1	0	1	0
BH15	B1	0	0	1
BH15	B1	1	0	0
BH15	B1	0	1	0
BH15	B1	0	0	1
CA21	B1	1	0	0
CA21	B1	1	0	0
CA21	B1	1	0	0
CA21	B1	0	1	0
CA21	B1	1	0	0
CA21	B1	0	1	0
CA21	B1	0	1	0
CA21	B1	1	0	0
CA21	B1	0	1	0
CA21	B1	1	0	0
CA21	B1	1	0	0

KI10	B1	1	0	0
KI10	B1	1	0	0
KI10	B1	1	0	0
KI10	B1	1	0	0
KI10	B1	1	0	0
KI10	B1	1	0	0
KI10	B1	1	0	0
KI10	B1	1	0	0
KI10	B1	1	0	0
KI10	B1	0	1	0
JO26	B1	0	1	0
JO26	B1	0	1	0
JO26	B1	1	0	0
JO26	B1	0	0	1
JO26	B1	0	0	1
JO26	B1	0	0	1
JO26	B1	0	0	1
JO26	B1	0	0	1
JO26	B1	0	1	0
JO26	B1	0	1	0
KA10b	B1	0	0	1
KA10b	B1	0	1	0
KA10b	B1	0	0	1
KA10b	B1	0	1	0
KA10b	B1	0	0	1
KA10b	B1	0	1	0
KA10b	B1	0	0	1
KA10b	B1	0	1	0
KA10b	B1	0	1	0
DA19	B1	0	1	0
DA19	B1	1	0	0
DA19	B1	1	0	0
DA19	B1	1	0	0
DA19	B1	1	0	0
DA19	B1	0	1	0
DA19	B1	1	0	0
LI09	B1	1	0	0
LI09	B1	1	0	0
LI09	B1	1	0	0
LI09	B1	1	0	0
LI09	B1	1	0	0
LI09	B1	1	0	0
LI09	B1	1	0	0
CH21	B1	1	0	0
CH21	B1	1	0	0
CH21	B1	0	1	0
CH21	B1	0	1	0
CH21	B1	0	1	0
CH21	B1	0	1	0
CH21	B1	1	0	0
SU11A	B1	0	1	0
SU11A	B1	0	1	0
SU11A	B1	1	0	0
SU11A	B1	1	0	0
SU11A	B1	0	1	0
JO04b	B1	0	1	0
JO04b	B1	1	0	0
JO04b	B1	1	0	0
JO04b	B1	1	0	0

JO04b	B1	1	0	0
JO04b	B1	1	0	0
JO04b	B1	1	0	0
JO04b	B1	1	0	0
JO04b	B1	1	0	0
JO04b	B1	1	0	0
SU08	A1	0	1	0
SU08	A1	1	0	0
SU08	A1	0	1	0
SU08	A1	1	0	0
SU08	A1	0	1	0
SU08	A1	1	0	0
SU08	A1	0	1	0
SU08	A1	1	0	0
SU08	A1	1	0	0
SU08	A1	1	0	0
SU08	A1	0	1	0
MA11a	A1	0	1	0
MA11a	A1	0	1	0
MA11a	A1	0	1	0
MA11a	A1	0	1	0
MA11a	A1	0	1	0
MA11a	A1	1	0	0
MA11a	A1	0	1	0
SH21	A1	0	1	0
SH21	A1	1	0	0
SH21	A1	0	1	0
SH21	A1	0	0	1
SH21	A1	0	0	1
SH21	A1	0	1	0
SH21	A1	1	0	0
SH21	A1	1	0	0
SH21	A1	1	0	0
SH21	A1	1	0	0
SH21	A1	0	1	0
SH21	A1	1	0	0
AL14	A1	1	0	0
AL14	A1	1	0	0
AL14	A1	1	0	0
AL14	A1	1	0	0
AL14	A1	1	0	0
AL14	A1	1	0	0
AL14	A1	1	0	0
AL14	A1	1	0	0
AL14	A1	1	0	0
AL14	A1	1	0	0
AL14	A1	1	0	0
KR20	A1	0	1	0
KR20	A1	0	1	0
KR20	A1	1	0	0
KR20	A1	0	0	1
KR20	A1	0	1	0
KR20	A1	0	1	0
KR20	A1	1	0	0
KR20	A1	0	1	0
MI18	A1	0	1	0
MI18	A1	0	1	0
MI18	A1	1	0	0
MI18	A1	0	1	0

MI18	A1	0	1	0
MI18	A1	0	1	0
MI18	A1	0	0	1
MI18	A1	0	0	1
MI18	A1	0	1	0
MI18	A1	0	1	0
MI18	A1	0	1	0
MI18	A1	1	0	0
MI18	A1	1	0	0
MI18	A1	1	0	0
MI18	A1	1	0	0
MI18	A1	0	1	0
KA10	A1	1	0	0
KA10	A1	1	0	0
KA10	A1	1	0	0
KA10	A1	1	0	0
KA10	A1	0	1	0
KA10	A1	1	0	0
KA10	A1	1	0	0
KA10	A1	0	1	0
KA10	A1	0	1	0
KA10	A1	1	0	0
MA11b	A1	0	0	1
MA11b	A1	0	1	0
MA11b	A1	1	0	0
MA11b	A1	0	1	0
MA11b	A1	0	0	1
MA11b	A1	0	1	0
MA11b	A1	0	1	0
ME11	A1	0	1	0
ME11	A1	1	0	0
ME11	A1	0	1	0
ME11	A1	0	1	0
ME11	A1	0	1	0
ME11	A1	1	0	0
ME11	A1	1	0	0
WE31	A1	1	0	0
WE31	A1	1	0	0
WE31	A1	1	0	0
WE31	A1	1	0	0
WE31	A1	1	0	0
WE31	A1	1	0	0
WE31	A1	1	0	0
WE31	A1	1	0	0
BE02	A1	1	0	0
BE02	A1	0	1	0
BE02	A1	0	1	0
BE02	A1	0	0	1
BE02	A1	0	1	0
BE02	A1	0	1	0
LA04	A1	1	0	0
LA04	A1	0	1	0
LA04	A1	0	1	0
LA04	A1	0	1	0
LA04	A1	1	0	0
MI02	A1	0	0	1
MI02	A1	0	0	1
MI02	A1	0	0	1
MI02	A1	0	0	1

MI02	A1	0	0	1
MI02	A1	0	0	1
MI02	A1	0	0	1
MI02	A1	0	1	0
MI02	A1	1	0	0
MI02	A1	0	0	1
MI02	A1	0	0	1
MI02	A1	0	1	0
MI02	A1	0	1	0
MI02	A1	0	0	1
PA27	A1	0	0	1
PA27	A1	0	0	1
PA27	A1	0	1	0
PA27	A1	0	1	0
PA27	A1	0	1	0
PA27	A1	0	1	0
PA27	A1	1	0	0
PA27	A1	0	1	0
NA21	A1	1	0	0
NA21	A1	1	0	0
NA21	A1	1	0	0
NA21	A1	1	0	0
NA21	A1	0	0	1
NA21	A1	0	0	1
NA21	A1	0	1	0
NA21	A1	0	1	0
NA21	A1	0	1	0
NA21	A1	0	1	0
NA21	A1	1	0	0
NA21	A1	0	1	0
NA21	A1	0	1	0
NA21	A1	0	1	0
MI29	A1	0	0	1
MI29	A1	0	0	1
MI29	A1	0	1	0
MI29	A1	0	1	0
MI29	A1	0	1	0
MI29	A1	0	0	1
MI29	A1	1	0	0
ML02	A1	0	1	0
ML02	A1	0	1	0
ML02	A1	0	1	0
ML02	A1	0	0	1
DA02	A1	1	0	0
DA02	A1	0	0	1
DA02	A1	0	1	0
DA02	A1	0	1	0
DA02	A1	0	0	1
DA02	A1	0	0	1
DA02	A1	0	1	0
DA02	A1	0	0	1
DA02	A1	0	1	0
DA02	A1	0	0	1
DA02	A1	0	1	0
DA02	A1	0	1	0
DA02	A1	0	0	1
DA02	A1	0	0	1
DA02	A1	0	0	1
DA02	A1	0	1	0

DA02	A1	0	1	0
DA02	A1	0	0	1
KI01	A1	1	0	0
KI01	A1	0	0	1
KI01	A1	0	0	1
KI01	A1	0	1	0
KI01	A1	0	0	1
KI01	A1	0	0	1
KI01	A1	0	1	0
KI01	A1	0	0	1
KI01	A1	0	1	0
KI01	A1	0	1	0
KI01	A1	0	1	0
KI01	A1	0	1	0
KI01	A1	0	1	0
KI01	A1	0	1	0
KI01	A1	0	1	0
KI01	A1	1	0	0
KI01	A1	0	1	0
KI01	A1	0	1	0
KI01	A1	0	1	0
LI11	A1	0	0	1
LI11	A1	0	1	0
LI11	A1	0	0	1
LI11	A1	0	1	0
LI11	A1	0	0	1
LI11	A1	1	0	0
LI11	A1	0	1	0
LI11	A1	0	1	0
JA12	A1	0	1	0
JA12	A1	0	1	0
JA12	A1	0	1	0
JA12	A1	1	0	0
JA12	A1	1	0	0
LA11	A1	0	1	0
LA11	A1	0	1	0
LA11	A1	1	0	0
LA11	A1	1	0	0
LA11	A1	0	1	0
LA11	A1	1	0	0
LA11	A1	0	1	0
LA11	A1	0	1	0
LA11	A1	1	0	0
LA11	A1	1	0	0
LA11	A1	1	0	0
LA11	A1	0	1	0
LA11	A1	0	1	0
LA11	A1	0	0	1
LE08	A1	0	1	0
LE08	A1	0	1	0
LE08	A1	0	1	0
LE08	A1	0	1	0
LE08	A1	0	1	0
CH01	A1	1	0	0
CH01	A1	1	0	0
CH01	A1	1	0	0
CH01	A1	1	0	0
CH01	A1	1	0	0
CH01	A1	1	0	0

CH01	A1	0	1	0
CH01	A1	1	0	0
CH01	A1	0	1	0
KA02	A1	0	1	0
KA02	A1	0	1	0
KA02	A1	0	0	1
KA02	A1	0	0	1
KA02	A1	0	1	0
KA02	A1	0	1	0
KA02	A1	0	1	0
KA02	A1	0	1	0
KA02	A1	1	0	0
KA02	A1	0	1	0
KA02	A1	0	1	0
KA02	A1	0	1	0
KA02	A1	0	1	0
KA02	A1	0	1	0
KA02	A1	0	1	0
SH16	A1	1	0	0
SH16	A1	1	0	0
SH16	A1	0	1	0
SH16	A1	0	1	0
SH16	A1	1	0	0
SH16	A1	1	0	0
SH16	A1	0	1	0
SH16	A1	1	0	0
BA25	A1	0	1	0
BA25	A1	0	1	0
BA25	A1	0	0	1
BA25	A1	0	0	1
BA25	A1	0	1	0
BA25	A1	1	0	0
BA25	A1	0	0	1
BA25	A1	0	1	0
BA25	A1	0	1	0
JE11	A1	0	1	0
JE11	A1	1	0	0
JE11	A1	0	1	0
JE11	A1	1	0	0
JE11	A1	0	1	0
JE11	A1	1	0	0
JE11	A1	0	1	0
JE11	A1	1	0	0
MI29a	A1	1	0	0
MI29a	A1	1	0	0
MI29a	A1	1	0	0
MI29a	A1	0	1	0
MI29a	A1	0	1	0
MI29a	A1	0	1	0
MI29a	A1	1	0	0
MI29a	A1	1	0	0
MI29a	A1	0	1	0
MI29b	A1	1	0	0
MI29b	A1	0	1	0
MI29b	A1	1	0	0
MI29b	A1	0	1	0
MI29b	A1	0	1	0
MI29b	A1	1	0	0
MI29b	A1	1	0	0

MI29b	A1	1	0	0
MI29b	A1	1	0	0
MI29b	A1	1	0	0
MI29b	A1	1	0	0
MI29b	A1	1	0	0
LA03	A1	0	1	0
LA03	A1	0	1	0
LA03	A1	0	1	0
LA03	A1	0	1	0
LA03	A1	0	1	0
LA03	A1	0	1	0
LA03	A1	1	0	0
LA03	A1	0	0	1
LA03	A1	0	1	0
SO05	A1	1	0	0
SO05	A1	1	0	0
SO05	A1	0	0	1
SO05	A1	0	1	0
SO05	A1	0	1	0
SO05	A1	0	0	1
SO05	A1	1	0	0
SO05	A1	1	0	0
KU92	A1	1	0	0
KU92	A1	0	1	0
KU92	A1	0	0	1
KU92	A1	0	0	1
KU92	A1	1	0	0
KU92	A1	1	0	0
KU92	A1	0	1	0
KU92	A1	1	0	0
KU92	A1	0	1	0
KU92	A1	0	1	0
KU92	A1	0	1	0
LA22	A1	1	0	0
LA22	A1	1	0	0
LA22	A1	0	0	1
LA22	A1	0	0	1
LA22	A1	0	0	1
LA22	A1	0	1	0
LA22	A1	0	0	1
LA22	A1	0	1	0
LA22	A1	1	0	0
LA22	A1	0	0	1
LA22	A1	1	0	0
LA22	A1	0	0	1
LA22	A1	0	0	1
SA04	A1	0	0	1
SA04	A1	0	0	1
SA04	A1	0	1	0
SA04	A1	0	1	0
SA04	A1	0	0	1
SA04	A1	1	0	0
SA04	A1	0	1	0
RE05	A1	0	0	1
RE05	A1	0	1	0
RE05	A1	0	0	1
RE05	A1	0	1	0
RE05	A1	0	0	1
RE05	A1	0	0	1

RE05	A1	0	1	0
MA08	A1	0	1	0
MA08	A1	1	0	0
MA08	A1	0	1	0
MA08	A1	0	1	0
MA08	A1	1	0	0
SU14	A1	0	1	0
SU14	A1	0	1	0
SU14	A1	0	1	0
SU14	A1	0	1	0
SU14	A1	0	1	0
SU14	A1	0	0	1
SU14	A1	0	0	1
SU14	A1	0	1	0
SU14	A1	0	0	1
SU14	A1	0	0	1
SU14	A1	0	1	0
SU14	A1	0	1	0
SU14	A1	0	0	1
SU14	A1	0	1	0
SU14	A1	1	0	0
SU11B	A1	0	1	0
SU11B	A1	0	1	0
SU11B	A1	0	0	1
SU11B	A1	0	0	1
SU11B	A1	0	1	0
SU11B	A1	0	1	0
SU11B	A1	0	1	0
SU11B	A1	0	1	0
SU11B	A1	0	1	0
SU11B	A1	0	1	0
TE27	A1	1	0	0
TE27	A1	1	0	0
TE27	A1	1	0	0
TE27	A1	0	1	0
TE27	A1	0	1	0
TE27	A1	1	0	0
TE27	A1	1	0	0
TE27	A1	0	1	0
TE27	A1	0	1	0
JA04b	A1	1	0	0
JA04b	A1	1	0	0
JA04b	A1	1	0	0
JA04b	A1	1	0	0
JA04b	A1	0	1	0
JA04b	A1	1	0	0
JA04b	A1	0	1	0
VI10	A1	0	1	0
VI10	A1	0	1	0
VI10	A1	0	1	0
VI10	A1	1	0	0
VI10	A1	1	0	0
VI10	A1	1	0	0
VI10	A1	0	1	0
VI10	A1	0	1	0
VI10	A1	0	1	0
VI10	A1	1	0	0
VI10	A1	1	0	0
VI10	A1	0	0	1

MI09	A1	1	0	0
MI09	A1	1	0	0
MI09	A1	1	0	0
MI09	A1	0	1	0
MI09	A1	0	1	0
MI09	A1	1	0	0
MI09	A1	1	0	0
MI09	A1	1	0	0
MI09	A1	1	0	0
MI09	A1	1	0	0
MI09	A1	1	0	0
MI09	A1	0	1	0
MI09	A1	1	0	0
MI09	A1	1	0	0
AN24	A1	0	0	1
AN24	A1	1	0	0
AN24	A1	0	1	0
AN24	A1	0	0	1
AN24	A1	0	0	1
AN24	A1	0	0	1
AN24	A1	0	0	1
AN24	A1	0	1	0
AN24	A1	0	0	1
AN24	A1	0	1	0
AN24	A1	0	1	0
AN24	A1	1	0	0
AN24	A1	1	0	0
AN24	A1	1	0	0
DI15	A1	0	0	1
DI15	A1	0	0	1
DI15	A1	0	0	1
DI15	A1	0	0	1
DI15	A1	0	1	0
DI15	A1	0	1	0
DI15	A1	0	1	0
DI15	A1	0	1	0
DI15	A1	0	1	0
DI15	A1	0	1	0
DI15	A1	0	1	0
DI15	A1	1	0	0
DI15	A1	0	1	0
DI15	A1	0	0	1
MA22	A1	0	1	0
MA22	A1	0	0	1
MA22	A1	0	1	0
MA22	A1	1	0	0
MA22	A1	1	0	0
MA22	A1	0	1	0
MA22	A1	0	1	0
MA22	A1	1	0	0
GI17	A1	1	0	0
GI17	A1	1	0	0
GI17	A1	0	1	0
GI17	A1	0	1	0
GI17	A1	0	1	0
GI17	A1	1	0	0
GI17	A1	0	1	0
AM05	A1	0	1	0
AM05	A1	0	1	0

AM05	A1	0	0	1
AM05	A1	0	1	0
AM05	A1	0	1	0
AM05	A1	0	0	1
AM05	A1	1	0	0
AM05	A1	0	0	1
LI04	A1	0	0	1
LI04	A1	0	1	0
LI04	A1	0	0	1
LI04	A1	0	1	0
LI04	A1	0	0	1
LI04	A1	0	0	1
LI04	A1	1	0	0
LI04	A1	1	0	0
LI04	A1	0	1	0
LI04	A1	0	1	0
LI04	A1	0	1	0
LI04	A1	0	0	1
LI04	A1	0	0	1
RE08	A1	0	1	0
RE08	A1	0	1	0
RE08	A1	0	1	0
RE08	A1	0	0	1
RE08	A1	0	1	0
RE08	A1	0	1	0
RE08	A1	0	1	0
RE08	A1	0	1	0
RE08	A1	1	0	0
GE08	A1	1	0	0
GE08	A1	0	1	0
GE08	A1	1	0	0
GE08	A1	1	0	0
GE08	A1	1	0	0
GE08	A1	1	0	0
GE08	A1	1	0	0
GE08	A1	0	1	0
GE08	A1	1	0	0
MA15	A1	0	0	1
MA15	A1	0	0	1
MA15	A1	0	0	1
MA15	A1	0	0	1
MA15	A1	0	1	0
MA15	A1	0	1	0
MA15	A1	0	1	0
MA15	A1	0	1	0
MA15	A1	0	1	0
MA15	A1	1	0	0
MA15	A1	0	0	1
CH05	A1	1	0	0
CH05	A1	1	0	0
CH05	A1	0	1	0
CH05	A1	1	0	0
CH05	A1	1	0	0
CH05	A1	1	0	0
CH05	A1	1	0	0
CH05	A1	1	0	0
VI20	A1	0	1	0
VI20	A1	0	1	0
VI20	A1	0	1	0

VI20	A1	0	1	0
VI20	A1	1	0	0
VI20	A1	0	1	0
VI20	A1	0	1	0
CH06	A1	0	1	0
CH06	A1	0	1	0
CH06	A1	0	1	0
CH06	A1	0	1	0
CH06	A1	0	1	0
CH06	A1	0	0	1
CH06	A1	0	0	1
MA10	A1	0	1	0
MA10	A1	1	0	0
MA10	A1	1	0	0
JU22	A1	1	0	0
JU22	A1	1	0	0
JU22	A1	0	1	0
JU22	A1	1	0	0
JU22	A1	1	0	0
JU22	A1	1	0	0
JU22	A1	0	1	0
JU22	A1	1	0	0
JU22	A1	1	0	0
JU22	A1	0	1	0
JU22	A1	1	0	0
JU22	A1	0	1	0
JU22	A1	0	1	0
JU22	A1	0	0	1
JU22	A1	0	0	1
JU22	A1	0	1	0
JU22	A1	0	1	0
JU22	A1	0	0	1
JU22	A1	0	0	1
ME12	A1	1	0	0
ME12	A1	1	0	0
ME12	A1	1	0	0
ME12	A1	0	1	0
ME12	A1	1	0	0
ME12	A1	1	0	0
ME12	A1	0	1	0
CH09	A1	1	0	0
CH09	A1	1	0	0
CH09	A1	1	0	0
CH09	A1	1	0	0
CH09	A1	1	0	0
CH09	A1	1	0	0
CH09	A1	1	0	0
CH09	A1	1	0	0
CH09	A1	1	0	0
CH09	A1	1	0	0
CH09	A1	0	1	0
CH09	A1	1	0	0
CH09	A1	1	0	0
KI12	A1	1	0	0
KI12	A1	0	1	0
KI12	A1	0	1	0
KI12	A1	1	0	0
KI12	A1	1	0	0
KI12	A1	0	1	0

KI12	A1	1	0	0
KI12	A1	0	1	0
KI12	A1	1	0	0
KI12	A1	0	0	1
KI12	A1	0	0	1
DE15	A1	0	0	1
DE15	A1	0	0	1
DE15	A1	0	0	1
DE15	A1	0	1	0
DE15	A1	0	0	1
DE15	A1	0	0	1
DE15	A1	0	1	0
DE15	A1	0	1	0
DE15	A1	0	1	0
LI04b	A1	1	0	0
LI04b	A1	1	0	0
LI04b	A1	0	1	0
LI04b	A1	0	1	0
LI04b	A1	1	0	0
LI04b	A1	1	0	0
LI04b	A1	0	1	0
LI04b	A1	0	1	0
LI04b	A1	1	0	0
LI04b	A1	1	0	0
LI04b	A1	0	1	0
LI04b	A1	1	0	0
LI04b	A1	0	1	0
LI04b	A1	0	1	0
LI04b	A1	1	0	0
LI04b	A1	1	0	0
LI04b	A1	1	0	0
JO24	A1	0	1	0
JO24	A1	0	1	0
JO24	A1	0	1	0
JO24	A1	0	1	0
JO24	A1	0	1	0
JO24	A1	0	1	0
AN18	A1	1	0	0
AN18	A1	0	1	0
AN18	A1	1	0	0
AN18	A1	1	0	0
AN18	A1	1	0	0
AN18	A1	1	0	0
AN18	A1	1	0	0
ME25	A1	0	1	0
ME25	A1	0	0	1
ME25	A1	0	1	0
ME25	A1	0	0	1
ME25	A1	0	1	0
ME25	A1	1	0	0
ME25	A1	1	0	0
ME25	A1	0	1	0
ME25	A1	0	1	0
ME25	A1	0	1	0
ME25	A1	0	0	1
ME25	A1	1	0	0
ME25	A1	1	0	0
ME25	A1	1	0	0
VI01	A1	1	0	0

VI01	A1	0	1	0
VI01	A1	1	0	0
VI01	A1	0	1	0
VI01	A1	1	0	0
VI01	A1	0	1	0
VI01	A1	1	0	0
MA12	A1	0	1	0
MA12	A1	0	0	1
MA12	A1	0	1	0
MA12	A1	0	1	0
MA12	A1	0	0	1
MA12	A1	0	0	1
MA12	A1	0	0	1
MA12	A1	0	0	1
MA12	A1	0	0	1
MA12	A1	0	0	1
MA12	A1	0	1	0
MA12	A1	0	0	1
MA12	A1	0	1	0
MA12	A1	0	1	0
KA02b	A1	0	0	1
KA02b	A1	0	0	1
KA02b	A1	0	0	1
KA02b	A1	0	1	0
KA02b	A1	0	1	0
KA02b	A1	0	0	1
KA02b	A1	0	1	0
SA04b	A1	0	1	0
SA04b	A1	1	0	0
SA04b	A1	1	0	0
SA04b	A1	1	0	0
SA04b	A1	1	0	0
SA04b	A1	1	0	0
SA04b	A1	1	0	0
SA04b	A1	0	1	0
SA04b	A1	1	0	0
SA04b	A1	1	0	0
SA04b	A1	0	1	0
SA04b	A1	1	0	0
SA04b	A1	0	1	0
SA04b	A1	1	0	0
SA04b	A1	0	1	0
JA04	A1	0	1	0
JA04	A1	1	0	0
JA04	A1	1	0	0
JA04	A1	1	0	0
JA04	A1	1	0	0
JA04	A1	0	1	0
JA04	A1	1	0	0
JA04	A1	1	0	0
JA04	A1	1	0	0
JA04	A1	1	0	0
JA04	A1	0	1	0
JA04	A1	1	0	0
JA04	A1	0	1	0
SU08	B2	1	0	0
SU08	B2	0	1	0
SU08	B2	1	0	0
SU08	B2	0	1	0

SU08	B2	1	0	0
SU08	B2	1	0	0
SU08	B2	1	0	0
SU08	B2	1	0	0
SU08	B2	1	0	0
SU08	B2	1	0	0
SU08	B2	0	1	0
MA11a	B2	0	1	0
MA11a	B2	0	1	0
MA11a	B2	1	0	0
MA11a	B2	0	1	0
MA11a	B2	1	0	0
MA11a	B2	1	0	0
MA11a	B2	1	0	0
MA11a	B2	1	0	0
MA11a	B2	1	0	0
MA11a	B2	1	0	0
MA11a	B2	0	1	0
MA11a	B2	1	0	0
SH21	B2	0	0	1
SH21	B2	0	0	1
SH21	B2	0	1	0
SH21	B2	0	1	0
SH21	B2	0	1	0
SH21	B2	0	1	0
SH21	B2	0	0	1
SH21	B2	0	1	0
SH21	B2	1	0	0
SH21	B2	1	0	0
SH21	B2	0	0	1
SH21	B2	0	1	0
SH21	B2	0	1	0
AL14	B2	1	0	0
AL14	B2	0	1	0
AL14	B2	1	0	0
AL14	B2	1	0	0
AL14	B2	1	0	0
AL14	B2	1	0	0
AL14	B2	1	0	0
AL14	B2	1	0	0
AL14	B2	1	0	0
AL14	B2	1	0	0
AL14	B2	1	0	0
AL14	B2	1	0	0
AL14	B2	1	0	0
AL14	B2	1	0	0
KR20	B2	0	1	0
KR20	B2	1	0	0
KR20	B2	1	0	0
KR20	B2	1	0	0
KR20	B2	1	0	0
KR20	B2	0	1	0
KR20	B2	1	0	0
KR20	B2	1	0	0
KR20	B2	1	0	0
KR20	B2	0	0	1
KR20	B2	1	0	0
KR20	B2	0	1	0
KR20	B2	0	1	0

MI18	B2	0	0	1
MI18	B2	0	0	1
MI18	B2	0	0	1
MI18	B2	1	0	0
MI18	B2	0	1	0
MI18	B2	0	1	0
MI18	B2	0	1	0
MI18	B2	0	1	0
MI18	B2	0	1	0
MI18	B2	0	0	1
MI18	B2	0	1	0
MI18	B2	0	1	0
MI18	B2	0	0	1
MI18	B2	0	0	1
MI18	B2	0	1	0
MI18	B2	0	0	1
MI18	B2	0	1	0
MI18	B2	0	1	0
KA10	B2	1	0	0
KA10	B2	0	1	0
KA10	B2	0	1	0
KA10	B2	1	0	0
KA10	B2	0	1	0
KA10	B2	1	0	0
KA10	B2	1	0	0
KA10	B2	1	0	0
KA10	B2	1	0	0
KA10	B2	0	1	0
KA10	B2	1	0	0
KA10	B2	0	1	0
KA10	B2	0	1	0
KA10	B2	1	0	0
KA10	B2	1	0	0
KA10	B2	1	0	0
KA10	B2	0	1	0
MA11b	B2	0	1	0
MA11b	B2	0	1	0
MA11b	B2	0	1	0
MA11b	B2	0	1	0
MA11b	B2	0	1	0
MA11b	B2	1	0	0
MA11b	B2	0	1	0
MA11b	B2	0	1	0
MA11b	B2	0	0	1
MA11b	B2	0	0	1
MA11b	B2	0	1	0
MA11b	B2	0	1	0
MA11b	B2	1	0	0
MA11b	B2	0	1	0
MA11b	B2	0	1	0
MA11b	B2	0	1	0
MA11b	B2	0	1	0
MA11b	B2	0	0	1
MA11b	B2	1	0	0
MA11b	B2	0	0	1
ME11	B2	1	0	0
ME11	B2	0	1	0
ME11	B2	0	1	0
ME11	B2	0	1	0

ME11	B2	1	0	0
WE31	B2	0	1	0
WE31	B2	1	0	0
WE31	B2	0	1	0
WE31	B2	0	1	0
WE31	B2	1	0	0
WE31	B2	0	1	0
WE31	B2	1	0	0
WE31	B2	0	1	0
WE31	B2	1	0	0
WE31	B2	0	1	0
BE02	B2	1	0	0
BE02	B2	0	0	1
BE02	B2	0	1	0
BE02	B2	1	0	0
BE02	B2	0	1	0
BE02	B2	0	1	0
BE02	B2	0	1	0
BE02	B2	0	0	1
LA04	B2	0	0	1
LA04	B2	0	0	1
LA04	B2	0	1	0
LA04	B2	0	1	0
LA04	B2	0	1	0
LA04	B2	1	0	0
LA04	B2	1	0	0
LA04	B2	0	1	0
LA04	B2	1	0	0
LA04	B2	1	0	0
LA04	B2	0	0	1
LA04	B2	0	0	1
LA04	B2	0	0	1
LA04	B2	0	1	0
LA04	B2	0	0	1
LA04	B2	0	0	1
LA04	B2	0	0	1
LA04	B2	0	1	0
MI02	B2	0	1	0
MI02	B2	0	0	1
MI02	B2	0	0	1
MI02	B2	0	0	1
MI02	B2	0	0	1
MI02	B2	0	0	1
MI02	B2	0	0	1
MI02	B2	0	0	1
MI02	B2	0	0	1
MI02	B2	0	0	1
MI02	B2	0	0	1
MI02	B2	0	0	1
MI02	B2	0	0	1
MI02	B2	0	1	0
MI02	B2	1	0	0
MI02	B2	0	0	1
MI02	B2	0	0	1
PA27	B2	0	0	1
PA27	B2	0	1	0
PA27	B2	0	1	0
PA27	B2	0	0	1
PA27	B2	0	1	0

PA27	B2	0	0	1
PA27	B2	0	1	0
PA27	B2	0	1	0
PA27	B2	0	1	0
NA21	B2	1	0	0
NA21	B2	0	1	0
NA21	B2	1	0	0
NA21	B3	0	1	0
NA21	B2	1	0	0
NA21	B2	1	0	0
NA21	B2	1	0	0
NA21	B2	1	0	0
NA21	B2	1	0	0
NA21	B2	0	1	0
NA21	B2	1	0	0
MI29	B2	1	0	0
MI29	B2	1	0	0
MI29	B2	1	0	0
MI29	B2	0	1	0
MI29	B2	0	1	0
MI29	B2	1	0	0
MI29	B2	1	0	0
MI29	B2	0	0	1
MI29	B2	0	1	0
MI29	B2	0	1	0
MI29	B2	0	1	0
ML02	B2	0	0	1
ML02	B2	0	1	0
ML02	B2	0	1	0
ML02	B2	0	1	0
ML02	B2	0	1	0
ML02	B2	0	1	0
ML02	B2	1	0	0
ML02	B2	1	0	0
ML02	B2	1	0	0
DA02	B2	1	0	0
DA02	B2	1	0	0
DA02	B2	1	0	0
DA02	B2	1	0	0
DA02	B2	0	1	0
DA02	B2	1	0	0
DA02	B2	1	0	0
DA02	B2	0	0	1
DA02	B2	0	1	0
DA02	B2	1	0	0
DA02	B2	1	0	0
KI01	B2	0	1	0
KI01	B2	0	0	1
KI01	B2	0	1	0
KI01	B2	0	0	1
KI01	B2	0	0	1
KI01	B2	0	1	0
KI01	B2	0	1	0
KI01	B2	0	1	0
KI01	B2	1	0	0
KI01	B2	0	0	1
KI01	B2	0	0	1
KI01	B2	0	0	1
KI01	B2	0	1	0

KI01	B2	0	1	0
KI01	B2	0	0	1
LI11	B2	0	1	0
LI11	B2	0	0	1
LI11	B2	0	0	1
LI11	B2	0	1	0
LI11	B2	0	0	1
LI11	B2	0	1	0
LI11	B2	0	0	1
LI11	B2	0	1	0
LI11	B2	1	0	0
LI11	B2	0	1	0
LI11	B2	1	0	0
LI11	B2	0	0	1
LI11	B2	0	0	1
LI11	B2	0	1	0
LI11	B2	0	1	0
JA12	B2	0	0	1
JA12	B2	0	1	0
JA12	B2	0	0	1
JA12	B2	0	0	1
JA12	B2	0	1	0
JA12	B2	0	1	0
JA12	B2	0	1	0
JA12	B2	0	1	0
JA12	B2	1	0	0
LA11	B2	0	1	0
LA11	B2	0	1	0
LA11	B2	0	1	0
LA11	B2	1	0	0
LA11	B2	0	1	0
LA11	B2	1	0	0
LA11	B2	1	0	0
LA11	B2	0	1	0
LA11	B2	1	0	0
LA11	B2	1	0	0
LA11	B2	0	0	1
LA11	B2	0	1	0
LA11	B2	0	0	1
LA11	B2	1	0	0
LA11	B2	1	0	0
LE08	B2	0	0	1
LE08	B2	1	0	0
LE08	B2	1	0	0
LE08	B2	0	1	0
LE08	B2	1	0	0
LE08	B2	0	1	0
LE08	B2	1	0	0
LE08	B2	1	0	0
LE08	B2	1	0	0
LE08	B2	1	0	0
LE08	B2	0	1	0
LE08	B2	0	1	0
LE08	B2	1	0	0
LE08	B2	0	1	0
LE08	B2	0	1	0
LE08	B2	1	0	0
LE08	B2	0	1	0
LE08	B2	0	1	0

LE08	B2	1	0	0
LE08	B2	1	0	0
CH01	B2	0	0	1
CH01	B2	0	1	0
CH01	B2	1	0	0
CH01	B2	1	0	0
CH01	B2	0	1	0
CH01	B2	0	1	0
CH01	B2	0	1	0
CH01	B2	0	1	0
CH01	B2	1	0	0
CH01	B2	0	1	0
CH01	B2	0	1	0
CH01	B2	0	1	0
KA02	B2	0	1	0
KA02	B2	0	1	0
KA02	B2	0	0	1
KA02	B2	1	0	0
KA02	B2	1	0	0
KA02	B2	0	1	0
KA02	B2	0	1	0
KA02	B2	0	1	0
KA02	B2	0	1	0
KA02	B2	1	0	0
KA02	B2	1	0	0
KA02	B2	0	1	0
KA02	B2	1	0	0
KA02	B2	0	1	0
KA02	B2	1	0	0
SH16	B2	1	0	0
SH16	B2	0	1	0
SH16	B2	1	0	0
SH16	B2	1	0	0
SH16	B2	1	0	0
SH16	B2	1	0	0
SH16	B2	0	1	0
SH16	B2	1	0	0
SH16	B2	0	1	0
SH16	B2	0	1	0
SH16	B2	0	1	0
SH16	B2	0	1	0
SH16	B2	1	0	0
SH16	B2	1	0	0
SH16	B2	1	0	0
BA25	B2	0	1	0
BA25	B2	0	1	0
BA25	B2	1	0	0
BA25	B2	0	1	0
BA25	B2	0	1	0
BA25	B2	0	1	0
BA25	B2	1	0	0
BA25	B2	0	1	0
BA25	B2	0	0	1
BA25	B2	0	0	1
BA25	B2	0	1	0
BA25	B2	0	1	0
BA25	B2	0	1	0
BA25	B2	0	0	1
JE11	B2	1	0	0

JE11	B2	1	0	0
JE11	B2	0	1	0
JE11	B2	1	0	0
JE11	B2	1	0	0
JE11	B2	1	0	0
JE11	B2	0	1	0
JE11	B2	0	1	0
JE11	B2	0	1	0
JE11	B2	0	1	0
JE11	B2	0	1	0
JE11	B2	1	0	0
JE11	B2	1	0	0
JE11	B2	1	0	0
JE11	B2	1	0	0
JE11	B2	0	1	0
JE11	B2	0	1	0
MI29a	B2	1	0	0
MI29a	B2	0	1	0
MI29a	B2	0	1	0
MI29a	B2	1	0	0
MI29a	B2	1	0	0
MI29a	B2	1	0	0
MI29a	B2	1	0	0
MI29a	B2	0	1	0
MI29a	B2	1	0	0
MI29a	B2	0	0	1
MI29a	B2	0	0	1
MI29a	B2	1	0	0
MI29a	B2	0	1	0
MI29a	B2	1	0	0
MI29a	B2	0	0	1
MI29a	B2	1	0	0
MI29a	B2	1	0	0
MI29b	B2	0	1	0
MI29b	B2	1	0	0
MI29b	B2	0	1	0
MI29b	B2	1	0	0
MI29b	B2	0	1	0
MI29b	B2	1	0	0
MI29b	B2	1	0	0
MI29b	B2	1	0	0
MI29b	B2	1	0	0
MI29b	B2	0	1	0
MI29b	B2	0	1	0
MI29b	B2	0	1	0
MI29b	B2	0	1	0
MI29b	B2	1	0	0
MI29b	B2	1	0	0
MI29b	B2	1	0	0
MI29b	B2	0	1	0
LA03	B2	0	0	1
LA03	B2	0	0	1
LA03	B2	0	0	1
LA03	B2	1	0	0
LA03	B2	0	1	0
LA03	B2	0	0	1
LA03	B2	0	0	1
LA03	B2	1	0	0
LA03	B2	0	0	1

LA03	B2	1	0	0
LA03	B2	1	0	0
LA03	B2	1	0	0
LA03	B2	0	1	0
LA03	B2	1	0	0
LA03	B2	1	0	0
SO05	B2	0	1	0
SO05	B2	0	1	0
SO05	B2	1	0	0
SO05	B2	0	1	0
SO05	B2	0	0	1
SO05	B2	0	0	1
SO05	B2	0	0	1
SO05	B2	0	1	0
SO05	B2	1	0	0
SO05	B2	1	0	0
KU92	B2	1	0	0
KU92	B2	1	0	0
KU92	B2	1	0	0
KU92	B2	0	1	0
KU92	B2	1	0	0
KU92	B2	1	0	0
KU92	B2	0	1	0
KU92	B2	1	0	0
KU92	B2	1	0	0
KU92	B2	1	0	0
KU92	B2	1	0	0
KU92	B2	1	0	0
KU92	B2	1	0	0
KU92	B2	0	1	0
KU92	B2	1	0	0
KU92	B2	1	0	0
KU92	B2	1	0	0
KU92	B2	1	0	0
LA22	B2	0	0	1
LA22	B2	1	0	0
LA22	B2	1	0	0
LA22	B2	1	0	0
LA22	B2	0	0	1
LA22	B2	0	0	1
LA22	B2	0	0	1
LA22	B2	0	0	1
LA22	B2	0	0	1
LA22	B2	0	0	1
LA22	B2	0	0	1
LA22	B2	0	1	0
LA22	B2	0	0	1
LA22	B2	0	0	1
LA22	B2	0	1	0
SA04	B2	0	0	1
SA04	B2	1	0	0
SA04	B2	1	0	0
SA04	B2	0	0	1
SA04	B2	0	0	1
SA04	B2	0	0	1
SA04	B2	0	1	0
SA04	B2	0	1	0
SA04	B2	0	1	0
SA04	B2	0	1	0

SA04	B2	0	1	0
SA04	B2	0	0	1
SA04	B2	0	1	0
RE05	B2	1	0	0
RE05	B2	0	1	0
RE05	B2	0	1	0
RE05	B2	0	1	0
RE05	B2	1	0	0
RE05	B2	1	0	0
RE05	B2	1	0	0
RE05	B2	0	1	0
RE05	B2	1	0	0
RE05	B2	0	1	0
MA08	B2	1	0	0
MA08	B2	1	0	0
MA08	B2	0	1	0
MA08	B2	0	1	0
MA08	B2	1	0	0
MA08	B2	1	0	0
MA08	B2	0	1	0
MA08	B2	1	0	0
MA08	B2	1	0	0
SU14	B2	0	0	1
SU14	B2	0	1	0
SU14	B2	0	1	0
SU14	B2	0	0	1
SU14	B2	0	0	1
SU14	B2	0	0	1
SU14	B2	1	0	0
SU14	B2	1	0	0
SU14	B2	1	0	0
SU14	B2	0	1	0
SU14	B2	0	1	0
SU14	B2	0	1	0
SU14	B2	0	1	0
SU14	B2	0	0	1
SU14	B2	1	0	0
SU14	B2	0	1	0
SU14	B2	0	1	0
SU14	B2	0	1	0
SU11B	B2	0	1	0
SU11B	B2	0	1	0
SU11B	B2	0	0	1
SU11B	B2	0	0	1
SU11B	B2	0	0	1
SU11B	B2	0	0	1
SU11B	B2	1	0	0
SU11B	B2	0	1	0
SU11B	B2	0	1	0
SU11B	B2	0	1	0
SU11B	B2	0	1	0
SU11B	B2	0	1	0
SU11B	B2	0	1	0
SU11B	B2	0	0	1
SU11B	B2	1	0	0
SU11B	B2	0	0	1
SU11B	B2	0	1	0
TE27	B2	1	0	0
TE27	B2	0	1	0

TE27	B2	0	1	0
TE27	B2	0	1	0
TE27	B2	1	0	0
TE27	B2	1	0	0
TE27	B2	1	0	0
TE27	B2	1	0	0
TE27	B2	1	0	0
TE27	B2	1	0	0
TE27	B2	0	1	0
TE27	B2	1	0	0
TE27	B2	1	0	0
TE27	B2	0	1	0
TE27	B2	1	0	0
TE27	B2	1	0	0
JA04b	B2	0	0	1
JA04b	B2	0	1	0
JA04b	B2	1	0	0
JA04b	B2	0	1	0
JA04b	B2	0	0	1
JA04b	B2	0	1	0
JA04b	B2	0	1	0
JA04b	B2	0	0	1
JA04b	B2	0	0	1
JA04b	B2	0	1	0
JA04b	B2	0	0	1
JA04b	B2	0	0	1
JA04b	B2	0	0	1
VI10	B2	0	1	0
VI10	B2	1	0	0
VI10	B2	0	0	1
VI10	B2	0	1	0
VI10	B2	0	1	0
VI10	B2	1	0	0
VI10	B2	1	0	0
VI10	B2	1	0	0
VI10	B2	0	1	0
VI10	B2	0	1	0
VI10	B2	0	1	0
MI09	B2	1	0	0
MI09	B2	1	0	0
MI09	B2	1	0	0
MI09	B2	1	0	0
MI09	B2	1	0	0
MI09	B2	1	0	0
MI09	B2	1	0	0
MI09	B2	0	1	0
MI09	B2	0	1	0
MI09	B2	1	0	0
MI09	B2	0	1	0
MI09	B2	1	0	0
MI09	B2	1	0	0
AN24	B2	0	0	1
AN24	B2	0	0	1
AN24	B2	0	0	1
AN24	B2	0	0	1
AN24	B2	1	0	0
AN24	B2	0	0	1
AN24	B2	0	1	0
AN24	B2	0	0	1

AN24	B2	0	0	1
AN24	B2	0	1	0
AN24	B2	0	1	0
AN24	B2	0	0	1
AN24	B2	0	1	0
AN24	B2	0	1	0
AN24	B2	0	1	0
AN24	B2	0	1	0
AN24	B2	1	0	0
AN24	B2	1	0	0
DI15	B2	0	0	1
DI15	B2	0	1	0
DI15	B2	0	0	1
DI15	B2	0	0	1
DI15	B2	0	1	0
DI15	B2	0	1	0
DI15	B2	0	0	1
DI15	B2	0	1	0
DI15	B2	0	0	1
DI15	B2	1	0	0
DI15	B2	0	0	1
DI15	B2	0	1	0
DI15	B2	1	0	0
DI15	B2	0	1	0
DI15	B2	0	1	0
MA22	B2	1	0	0
MA22	B2	0	1	0
MA22	B2	1	0	0
MA22	B2	1	0	0
MA22	B2	0	1	0
MA22	B2	1	0	0
MA22	B2	0	0	1
MA22	B2	1	0	0
MA22	B2	0	1	0
MA22	B2	0	0	1
MA22	B2	1	0	0
MA22	B2	1	0	0
MA22	B2	1	0	0
GI17	B2	0	1	0
GI17	B2	1	0	0
GI17	B2	1	0	0
GI17	B2	0	1	0
GI17	B2	1	0	0
GI17	B2	0	0	1
GI17	B2	0	1	0
GI17	B2	0	1	0
AM05	B2	0	1	0
AM05	B2	0	0	1
AM05	B2	0	0	1
AM05	B2	0	1	0
AM05	B2	0	1	0
AM05	B2	0	1	0
AM05	B2	0	1	0
AM05	B2	0	0	1
AM05	B2	0	1	0
AM05	B2	1	0	0
LI04	B2	0	1	0
LI04	B2	0	0	1
LI04	B2	0	1	0

LI04	B2	0	1	0
LI04	B2	1	0	0
LI04	B2	1	0	0
LI04	B2	1	0	0
LI04	B2	0	1	0
LI04	B2	0	0	1
RE08	B2	0	1	0
RE08	B2	1	0	0
RE08	B2	1	0	0
RE08	B2	0	1	0
RE08	B2	0	1	0
RE08	B2	0	1	0
RE08	B2	0	1	0
RE08	B2	0	1	0
GE08	B2	1	0	0
GE08	B2	1	0	0
GE08	B2	1	0	0
GE08	B2	1	0	0
GE08	B2	1	0	0
GE08	B2	0	1	0
GE08	B2	1	0	0
GE08	B2	1	0	0
GE08	B2	1	0	0
GE08	B2	0	1	0
GE08	B2	1	0	0
MA15	B2	0	1	0
MA15	B2	1	0	0
MA15	B2	0	1	0
MA15	B2	0	0	1
MA15	B2	0	1	0
MA15	B2	0	1	0
MA15	B2	0	1	0
MA15	B2	0	0	1
MA15	B2	0	1	0
MA15	B2	0	1	0
MA15	B2	0	1	0
MA15	B2	0	1	0
MA15	B2	1	0	0
MA15	B2	0	0	1
CH05	B2	1	0	0
CH05	B2	1	0	0
CH05	B2	0	1	0
CH05	B2	0	1	0
CH05	B2	1	0	0
CH05	B2	1	0	0
CH05	B2	1	0	0
CH05	B2	0	1	0
CH05	B2	1	0	0
CH05	B2	1	0	0
CH05	B2	1	0	0
CH05	B2	0	1	0
CH05	B2	1	0	0
CH05	B2	0	1	0
CH05	B2	0	1	0
CH05	B2	0	1	0
CH05	B2	0	1	0
VI20	B2	0	1	0
VI20	B2	1	0	0
VI20	B2	1	0	0

VI20	B2	1	0	0
VI20	B2	0	0	1
VI20	B2	1	0	0
VI20	B2	0	1	0
VI20	B2	1	0	0
VI20	B2	1	0	0
CH06	B2	1	0	0
CH06	B2	0	1	0
CH06	B2	0	1	0
CH06	B2	1	0	0
CH06	B2	0	1	0
CH06	B2	1	0	0
CH06	B2	0	1	0
CH06	B2	0	1	0
CH06	B2	0	0	1
CH06	B2	0	1	0
CH06	B2	1	0	0
CH06	B2	0	1	0
CH06	B2	1	0	0
CH06	B2	1	0	0
CH06	B2	0	1	0
CH06	B2	0	1	0
MA10	B2	0	1	0
MA10	B2	1	0	0
MA10	B2	0	1	0
MA10	B2	0	1	0
MA10	B2	0	1	0
MA10	B2	1	0	0
MA10	B2	1	0	0
MA10	B2	1	0	0
MA10	B2	1	0	0
MA10	B2	0	1	0
MA10	B2	1	0	0
MA10	B2	0	1	0
MA10	B2	1	0	0
MA10	B2	1	0	0
JU22	B2	0	1	0
JU22	B2	0	1	0
JU22	B2	1	0	0
JU22	B2	0	1	0
JU22	B2	0	1	0
JU22	B2	1	0	0
JU22	B2	1	0	0
JU22	B2	1	0	0
JU22	B2	1	0	0
JU22	B2	1	0	0
JU22	B2	0	1	0
JU22	B2	1	0	0
JU22	B2	0	0	1
JU22	B2	0	1	0
JU22	B2	0	1	0
JU22	B2	0	1	0
JU22	B2	0	1	0
JU22	B2	0	1	0
JU22	B2	0	1	0
JU22	B2	0	0	1
JU22	B2	0	1	0
JU22	B2	0	1	0
ME12	B2	1	0	0

ME12	B2	1	0	0
ME12	B2	1	0	0
ME12	B2	1	0	0
ME12	B2	1	0	0
ME12	B2	1	0	0
ME12	B2	0	1	0
CH09	B2	1	0	0
CH09	B2	0	1	0
CH09	B2	0	1	0
CH09	B2	1	0	0
CH09	B2	1	0	0
CH09	B2	1	0	0
CH09	B2	1	0	0
CH09	B2	1	0	0
CH09	B2	0	1	0
CH09	B2	1	0	0
CH09	B2	1	0	0
CH09	B2	0	1	0
CH09	B2	0	1	0
CH09	B2	0	1	0
CH09	B2	1	0	0
KI12	B2	0	1	0
KI12	B2	1	0	0
KI12	B2	1	0	0
KI12	B2	0	1	0
KI12	B2	0	1	0
KI12	B2	1	0	0
KI12	B2	1	0	0
KI12	B2	0	1	0
KI12	B2	1	0	0
KI12	B2	0	1	0
KI12	B2	0	1	0
KI12	B2	1	0	0
KI12	B2	1	0	0
KI12	B2	1	0	0
KI12	B2	0	1	0
KI12	B2	0	0	1
KI12	B2	0	0	1
KI12	B2	0	1	0
KI12	B2	1	0	0
DE15	B2	0	1	0
DE15	B2	0	1	0
DE15	B2	0	0	1
DE15	B2	0	0	1
DE15	B2	0	0	1
DE15	B2	0	0	1
DE15	B2	0	1	0
DE15	B2	0	1	0
DE15	B2	0	1	0
DE15	B2	0	0	1
DE15	B2	0	1	0
DE15	B2	0	1	0
DE15	B2	1	0	0
DE15	B2	0	1	0
DE15	B2	0	1	0
DE15	B2	0	0	1
DE15	B2	0	1	0
DE15	B2	0	1	0
LI04b	B2	1	0	0

LI04b	B2	1	0	0
LI04b	B2	1	0	0
LI04b	B2	0	1	0
LI04b	B2	0	1	0
LI04b	B2	1	0	0
LI04b	B2	1	0	0
LI04b	B2	0	1	0
LI04b	B2	1	0	0
LI04b	B2	0	1	0
LI04b	B2	1	0	0
LI04b	B2	0	1	0
LI04b	B2	1	0	0
LI04b	B2	1	0	0
LI04b	B2	1	0	0
LI04b	B2	0	1	0
LI04b	B2	0	1	0
LI04b	B2	1	0	0
LI04b	B2	1	0	0
LI04b	B2	0	1	0
LI04b	B2	1	0	0
LI04b	B2	0	1	0
LI04b	B2	1	0	0
LI04b	B2	1	0	0
LI04b	B2	0	1	0
JO24	B2	0	1	0
JO24	B2	1	0	0
JO24	B2	0	0	1
JO24	B2	0	1	0
JO24	B2	0	1	0
JO24	B2	1	0	0
JO24	B2	1	0	0
JO24	B2	1	0	0
AN18	B2	0	1	0
AN18	B2	0	1	0
AN18	B2	0	1	0
AN18	B2	0	1	0
AN18	B2	0	1	0
AN18	B2	0	1	0
AN18	B2	0	1	0
AN18	B2	1	0	0
AN18	B2	1	0	0
AN18	B2	1	0	0
AN18	B2	1	0	0
AN18	B2	0	1	0
AN18	B2	1	0	0
AN18	B2	0	1	0
AN18	B2	0	1	0
AN18	B2	0	1	0
AN18	B2	0	1	0
AN18	B2	0	1	0
AN18	B2	1	0	0
AN18	B2	1	0	0
AN18	B2	0	1	0
AN18	B2	0	1	0
AN18	B2	1	0	0
AN18	B2	1	0	0
AN18	B2	1	0	0
AN18	B2	0	1	0
AN18	B2	1	0	0

AN18	B2	1	0	0
AN18	B2	1	0	0
AN18	B2	1	0	0
AN18	B2	1	0	0
AN18	B2	1	0	0
AN18	B2	1	0	0
ME25	B2	0	0	1
ME25	B2	0	0	1
ME25	B2	0	0	1
ME25	B2	0	1	0
ME25	B2	0	0	1
ME25	B2	0	1	0
ME25	B2	0	1	0
ME25	B2	1	0	0
ME25	B2	0	1	0
ME25	B2	0	1	0
ME25	B2	1	0	0
ME25	B2	0	0	1
ME25	B2	0	0	1
ME25	B2	0	1	0
VI01	B2	0	1	0
VI01	B2	0	1	0
VI01	B2	0	1	0
VI01	B2	1	0	0
VI01	B2	1	0	0
VI01	B2	1	0	0
VI01	B2	1	0	0
VI01	B2	1	0	0
VI01	B2	1	0	0
VI01	B2	0	1	0
VI01	B2	0	1	0
VI01	B2	0	1	0
VI01	B2	1	0	0
VI01	B2	1	0	0
VI01	B2	1	0	0
VI01	B2	0	1	0
VI01	B2	1	0	0
VI01	B2	0	1	0
MA12	B2	0	1	0
MA12	B2	0	0	1
MA12	B2	0	0	1
MA12	B2	0	1	0
MA12	B2	0	1	0
MA12	B2	0	1	0
MA12	B2	0	0	1
MA12	B2	0	1	0
MA12	B2	0	1	0
MA12	B2	0	1	0
MA12	B2	0	1	0
MA12	B2	0	1	0
MA12	B2	0	1	0
MA12	B2	0	1	0
MA12	B2	0	1	0
MA12	B2	0	1	0
MA12	B2	0	0	1
MA12	B2	1	0	0
KA02b	B2	0	1	0
KA02b	B2	0	0	1
KA02b	B2	0	0	1

KA02b	B2	0	1	0
KA02b	B2	0	0	1
KA02b	B2	0	1	0
KA02b	B2	0	0	1
KA02b	B2	0	1	0
KA02b	B2	0	0	1
KA02b	B2	0	0	1
KA02b	B2	0	0	1
KA02b	B2	0	0	1
SA04b	B2	1	0	0
SA04b	B2	1	0	0
SA04b	B2	1	0	0
SA04b	B2	1	0	0
SA04b	B2	0	1	0
SA04b	B2	1	0	0
SA04b	B2	1	0	0
SA04b	B2	0	1	0
SA04b	B2	0	1	0
SA04b	B2	1	0	0
SA04b	B2	1	0	0
SA04b	B2	1	0	0
SA04b	B2	1	0	0
SA04b	B2	0	1	0
SA04b	B2	1	0	0
JA04	B2	1	0	0
JA04	B2	1	0	0
JA04	B2	1	0	0
JA04	B2	1	0	0
JA04	B2	1	0	0
JA04	B2	1	0	0
JA04	B2	1	0	0
JA04	B2	1	0	0
JA04	B2	1	0	0
JA04	B2	1	0	0
JA04	B2	0	1	0
JA04	B2	1	0	0
JA04	B2	1	0	0
JA04	B2	1	0	0
JA04	B2	0	1	0
JA04	B2	1	0	0
JA04	B2	1	0	0
JA04	B2	1	0	0
JA04	B2	1	0	0
AN09	A2	0	1	0
AN09	A2	1	0	0
AN09	A2	0	0	1
AN09	A2	0	0	1
AN09	A2	0	1	0
AN09	A2	0	1	0
AN09	A2	0	1	0
AN09	A2	0	0	1
AN09	A2	0	0	1
AN09	A2	0	1	0
GI21	A2	1	0	0
GI21	A2	1	0	0
GI21	A2	1	0	0
GI21	A2	0	1	0
GI21	A2	0	1	0
GI21	A2	1	0	0

GI21	A2	1	0	0
GI21	A2	1	0	0
GI21	A2	0	1	0
GI21	A2	1	0	0
GI21	A2	0	0	1
GI21	A2	0	1	0
GI21	A2	0	0	1
GI21	A2	0	0	1
GI21	A2	0	1	0
GI21	A2	0	1	0
GI21	A2	1	0	0
GI21	A2	0	1	0
GI21	A2	0	1	0
GI21	A2	1	0	0
CH15	A2	0	1	0
CH15	A2	0	1	0
CH15	A2	1	0	0
CH15	A2	0	0	1
CH15	A2	0	1	0
CH15	A2	0	1	0
CH15	A2	0	0	1
CH15	A2	1	0	0
CH15	A2	1	0	0
CH15	A2	1	0	0
CH15	A2	0	1	0
CH15	A2	1	0	0
CH15	A2	0	0	1
CH15	A2	0	0	1
CH15	A2	1	0	0
CH15	A2	0	1	0
CH15	A2	0	0	1
CH15	A2	0	1	0
CH15	A2	1	0	0
CH15	A2	1	0	0
CH15	A2	0	0	1
CH15	A2	0	1	0
CH15	A2	0	0	1
CH15	A2	0	0	1
CH15	A2	0	0	1
CH15	A2	0	0	1
SU02	A2	0	1	0
SU02	A2	1	0	0
SU02	A2	1	0	0
SU02	A2	1	0	0
SU02	A2	0	1	0
SU02	A2	0	1	0
SU02	A2	0	1	0
SU02	A2	0	1	0
SU02	A2	1	0	1
SU02	A2	1	0	0
SU02	A2	0	0	1
SU02	A2	0	1	0
SU02	A2	0	1	0
LO01	A2	1	0	0
LO01	A2	1	0	0
LO01	A2	0	1	0
LO01	A2	0	1	0
LO01	A2	0	1	0
LO01	A2	1	0	0

LO01	A2	1	0	0
LO01	A2	0	1	0
LO01	A2	1	0	0
LO01	A2	1	0	0
LO01	A2	1	0	0
LO01	A2	0	1	0
LO01	A2	1	0	0
LO01	A2	1	0	0
LO01	A2	1	0	0
LO01	A2	0	1	0
LO01	A2	1	0	0
LO01	A2	1	0	0
LO01	A2	1	0	0
JU02	A2	1	0	0
JU02	A2	0	1	0
JU02	A2	0	1	0
JU02	A2	0	1	0
JU02	A2	0	1	0
JU02	A2	1	0	0
JU02	A2	0	1	0
JU02	A2	0	1	0
JU02	A2	0	1	0
JU02	A2	0	0	1
JU02	A2	0	0	1
JU02	A2	1	0	0
JU02	A2	1	0	0
JU02	A2	0	1	0
LO03	A2	1	0	0
LO03	A2	0	1	0
LO03	A2	0	1	0
LO03	A2	1	0	0
LO03	A2	1	0	0
LO03	A2	0	1	0
LO03	A2	1	0	0
LO03	A2	1	0	0
LO03	A2	1	0	0
LO03	A2	1	0	0
LO03	A2	1	0	0
AM20	A2	0	1	0
AM20	A2	1	0	0
AM20	A2	0	1	0
AM20	A2	0	1	0
AM20	A2	0	1	0
AM20	A2	0	1	0
AM20	A2	0	1	0
MA19	A2	0	0	1
MA19	A2	0	1	0
MA19	A2	0	1	0
MA19	A2	0	1	0
MA19	A2	0	0	1
MA19	A2	0	1	0
MA19	A2	0	0	1
MA19	A2	0	0	1
MA19	A2	0	0	1
MA19	A2	0	0	1
MA19	A2	0	1	0
MA19	A2	0	1	0
MA19	A2	0	0	1
MA19	A2	0	0	1

MA19	A2	0	1	0
MA19	A2	0	1	0
MA19	A2	1	0	0
MA19	A2	0	0	1
MA19	A2	0	0	1
MA19	A2	0	1	0
MA19	A2	0	0	1
MA19	A2	1	0	0
MA19	A2	1	0	0
MA19	A2	0	1	0
MA19	A2	1	0	0
MA19	A2	0	0	1
SA11	A2	0	1	0
SA11	A2	0	0	1
SA11	A2	0	1	0
SA11	A2	0	0	1
SA11	A2	0	1	0
SA11	A2	0	1	0
SA11	A2	0	1	0
SA11	A2	0	1	0
SA11	A2	0	1	0
SA11	A2	0	0	1
SA11	A2	0	1	0
SA11	A2	0	0	1
SA11	A2	0	1	0
SA11	A2	0	0	1
SA11	A2	0	1	0
SA11	A2	0	1	0
SA11	A2	0	0	1
SA11	A2	0	0	1
SA11	A2	0	0	1
SA11	A2	0	1	0
SA11	A2	1	0	0
JE06	A2	0	1	0
JE06	A2	0	0	1
JE06	A2	0	0	1
JE06	A2	0	0	1
JE06	A2	0	1	0
JE06	A2	0	1	0
JE06	A2	0	1	0
JE06	A2	0	1	0
JE06	A2	1	0	0
JE06	A2	0	1	0
JE06	A2	1	0	0
JE06	A2	0	1	0
JE06	A2	0	0	1
JE06	A2	0	0	1
JE06	A2	0	1	0
JE06	A2	1	0	0
JE06	A2	1	0	0
JE06	A2	0	1	0
JE06	A2	1	0	0
JE06	A2	0	1	0
JE06	A2	1	0	0
JE10	A2	0	1	0
JE10	A2	1	0	0
JE10	A2	1	0	0
JE10	A2	1	0	0
JE10	A2	1	0	0

JE10	A2	0	1	0
JE10	A2	1	0	0
JE10	A2	1	0	0
JE10	A2	1	0	0
JE10	A2	1	0	0
JE10	A2	0	1	0
JE10	A2	1	0	0
JE10	A2	1	0	0
JE10	A2	1	0	0
JE10	A2	0	1	0
JE10	A2	0	1	0
JE10	A2	1	0	0
JE10	A2	0	1	0
JE10	A2	0	1	0
JE10	A2	0	1	0
JE10	A2	1	0	0
JE10	A2	1	0	0
JE10	A2	1	0	0
TA06	A2	0	1	0
TA06	A2	0	0	1
TA06	A2	0	0	1
TA06	A2	1	0	0
TA06	A2	1	0	0
TA06	A2	0	1	0
TA06	A2	1	0	0
TA06	A2	0	1	0
TA06	A2	1	0	0
TA06	A2	1	0	0
TA06	A2	1	0	0
TA06	A2	1	0	0
TA06	A2	1	0	0
TA06	A2	0	1	0
TA06	A2	1	0	0
TA06	A2	0	1	0
TA06	A2	0	1	0
TA06	A2	0	1	0
TA06	A2	1	0	0
TA06	A2	0	1	0
TA06	A2	1	0	0
TA06	A2	1	0	0
TA06	A2	0	0	1
BR02	A2	0	1	0
BR02	A2	1	0	0
BR02	A2	1	0	0
BR02	A2	1	0	0
BR02	A2	1	0	0
AN11	A2	0	1	0
AN11	A2	0	0	1
AN11	A2	0	0	1
AN11	A2	0	1	0
AN11	A2	0	1	0
AN11	A2	0	0	1
AN11	A2	0	0	1
AN11	A2	1	0	0
AN11	A2	0	1	0
AN11	A2	0	1	0
KA05	A2	0	0	1
KA05	A2	0	0	1
KA05	A2	0	1	0

KA05	A2	0	1	0
KA05	A2	0	0	1
KA05	A2	0	1	0
KA05	A2	0	1	0
KA05	A2	0	1	0
KA05	A2	1	0	0
CI26	A2	0	0	1
CI26	A2	0	0	1
CI26	A2	0	0	1
CI26	A2	0	1	0
CI26	A2	0	0	1
CI26	A2	0	1	0
CI26	A2	0	1	0
CI26	A2	0	1	0
CI26	A2	0	0	1
CI26	A2	0	1	0
CI26	A2	0	1	0
CI26	A2	0	1	0
CI26	A2	0	1	0
CI26	A2	0	1	0
CI26	A2	0	0	1
CI26	A2	0	1	0
CI26	A2	0	1	0
LY04	A2	1	0	0
LY04	A2	1	0	0
LY04	A2	0	1	0
LY04	A2	0	1	0
LY04	A2	1	0	0
LY04	A2	0	1	0
LY04	A2	1	0	0
LY04	A2	1	0	0
LY04	A2	0	1	0
LY04	A2	1	0	0
LY04	A2	1	0	0
LY04	A2	1	0	0
LY04	A2	0	1	0
LY04	A2	1	0	0
LY04	A2	0	1	0
LY04	A2	1	0	0
JE17	A2	1	0	0
JE17	A2	1	0	0
JE17	A2	1	0	0
JE17	A2	1	0	0
JE17	A2	1	0	0
JE17	A2	1	0	0
JE17	A2	1	0	0
JE17	A2	0	1	0
JE17	A2	1	0	0
JE17	A2	0	1	0
JE17	A2	0	1	0
JE17	A2	0	1	0
JE17	A2	0	1	0
JE17	A2	0	1	0
JE17	A2	0	1	0
JE17	A2	1	0	0
SA06	A2	0	1	0
SA06	A2	0	1	0
SA06	A2	1	0	0
SA06	A2	0	1	0

SA06	A2	1	0	0
SA06	A2	1	0	0
SA06	A2	0	1	0
SA06	A2	0	1	0
SA06	A2	1	0	0
SA06	A2	1	0	0
SA06	A2	1	0	0
SA06	A2	0	0	1
SA06	A2	0	1	0
SA06	A2	0	1	0
SA06	A2	1	0	0
SA06	A2	0	1	0
SA06	A2	0	1	0
MA02	A2	1	0	0
MA02	A2	0	1	0
MA02	A2	1	0	0
MA02	A2	1	0	0
MA02	A2	1	0	0
MA02	A2	0	1	0
MA02	A2	1	0	0
MA02	A2	1	0	0
MA02	A2	1	0	0
MA02	A2	1	0	0
MA02	A2	1	0	0
MA02	A2	0	1	0
MA02	A2	0	1	0
MA02	A2	1	0	0
MA02	A2	0	1	0
MA02	A2	0	1	0
MA02	A2	1	0	0
MA02	A2	1	0	0
CA11	A2	0	1	0
CA11	A2	0	1	0
CA11	A2	0	1	0
CA11	A2	0	1	0
CA11	A2	0	1	0
CA11	A2	1	0	0
CA11	A2	0	1	0
CA11	A2	0	1	0
CA11	A2	1	0	0
CA11	A2	1	0	0
MA01a	A2	0	1	0
MA01a	A2	0	1	0
MA01a	A2	0	1	0
MA01a	A2	1	0	0
MA01a	A2	0	1	0
MA01a	A2	1	0	0
MA01a	A2	0	1	0
JO04	A2	1	0	0
JO04	A2	1	0	0
JO04	A2	1	0	0
JO04	A2	0	1	0
JO04	A2	1	0	0
JO04	A2	1	0	0
JO04	A2	0	1	0
JO04	A2	0	1	0
JO04	A2	1	0	0
JO04	A2	0	1	0
JO04	A2	1	0	0

JO04	A2	0	1	0
JO04	A2	1	0	0
JO04	A2	0	0	1
JO04	A2	1	0	0
JO04	A2	1	0	0
JO04	A2	0	1	0
JO04	A2	1	0	0
JO04	A2	0	1	0
JO04	A2	0	1	0
JO04	A2	0	1	0
JO04	A2	1	0	0
JO04	A2	1	0	0
JO04	A2	0	1	0
LA07	A2	0	1	0
LA07	A2	1	0	0
LA07	A2	0	1	0
LA07	A2	1	0	0
LA07	A2	0	1	0
LA07	A2	0	1	0
LA07	A2	0	1	0
LA07	A2	1	0	0
LA07	A2	0	1	0
LA07	A2	0	1	0
LA07	A2	1	0	0
LA07	A2	1	0	0
LA07	A2	1	0	0
LA07	A2	0	1	0
LA07	A2	0	1	0
LA07	A2	1	0	0
LA07	A2	0	1	0
MI16	A2	0	0	1
MI16	A2	0	0	1
MI16	A2	0	0	1
MI16	A2	0	1	0
MI16	A2	0	1	0
MI16	A2	0	1	0
MI16	A2	0	1	0
MI16	A2	0	1	0
MI16	A2	0	1	0
MI16	A2	0	1	0
MI16	A2	0	1	0
MI16	A2	0	1	0
MI16	A2	0	1	0
MI16	A2	0	1	0
MI16	A2	0	1	0
MI16	A2	0	1	0
MI16	A2	1	0	0
MI16	A2	0	0	1
CH02	A2	1	0	0
CH02	A2	0	1	0
CH02	A2	0	1	0
CH02	A2	0	1	0
CH02	A2	0	1	0
CH02	A2	0	1	0
CH02	A2	0	1	0
CH02	A2	1	0	0
CH02	A2	1	0	0
CH02	A2	1	0	0
CH02	A2	0	1	0

CH02	A2	0	0	1
LI14	A2	0	1	0
LI14	A2	0	1	0
LI14	A2	1	0	0
LI14	A2	1	0	0
LI14	A2	0	1	0
LI14	A2	1	0	0
LI14	A2	1	0	0
LI14	A2	0	1	0
LI14	A2	0	1	0
LI14	A2	1	0	0
LI14	A2	1	0	0
LI14	A2	1	0	0
LI14	A2	0	1	0
CH11	A2	1	0	0
CH11	A2	0	1	0
CH11	A2	0	1	0
CH11	A2	0	1	0
CH11	A2	0	1	0
CH11	A2	0	0	1
CH11	A2	0	0	1
CH11	A2	0	1	0
CH11	A2	0	1	0
CH11	A2	0	1	0
TE30	A2	0	1	0
TE30	A2	0	0	1
TE30	A2	0	1	0
TE30	A2	0	1	0
TE30	A2	0	1	0
TE30	A2	0	1	0
TE30	A2	0	1	0
TE30	A2	0	1	0
TE30	A2	0	1	0
TE30	A2	0	0	1
TE30	A2	0	1	0
TE30	A2	1	0	0
TE30	A2	1	0	0
MA01b	A2	1	0	0
MA01b	A2	0	1	0
MA01b	A2	1	0	0
MA01b	A2	0	1	0
MA01b	A2	1	0	0
MA01b	A2	0	1	0
MA01b	A2	1	0	0
MA01b	A2	1	0	0
MA01b	A2	1	0	0
MA01b	A2	1	0	0
MA01b	A2	0	1	0
MA01b	A2	1	0	0
BA23	A2	1	0	0
BA23	A2	0	1	0
BA23	A2	1	0	0
BA23	A2	1	0	0
BA23	A2	0	1	0
BA23	A2	1	0	0
BA23	A2	1	0	0
BA23	A2	1	0	0
BA23	A2	0	1	0
BA23	A2	1	0	0

BA23	A2	0	1	0
BA23	A2	1	0	0
BA23	A2	1	0	0
BA23	A2	0	1	0
BA23	A2	1	0	0
KA19	A2	0	0	1
KA19	A2	0	1	0
KA19	A2	0	0	1
KA19	A2	0	0	1
KA19	A2	0	1	0
KA19	A2	0	0	1
KA19	A2	0	0	1
KA19	A2	0	0	1
KA19	A2	0	1	0
KA19	A2	0	1	0
KA19	A2	0	1	0
KA19	A2	0	0	1
KA19	A2	0	0	1
KA19	A2	0	1	0
KA19	A2	0	1	0
KA19	A2	0	1	0
KA19	A2	0	1	0
KA19	A2	0	0	1
KA19	A2	0	0	1
KA19	A2	0	1	0
KA19	A2	0	1	0
KA19	A2	0	1	0
KA19	A2	0	0	1
TA18	A2	0	1	0
TA18	A2	1	0	0
TA18	A2	1	0	0
TA18	A2	1	0	0
TA18	A2	0	1	0
TA18	A2	1	0	0
TA18	A2	1	0	0
TA18	A2	0	1	0
TA18	A2	1	0	0
TA18	A2	1	0	0
TA18	A2	1	0	0
TA18	A2	0	1	0
TA18	A2	0	0	1
TA18	A2	1	0	0
DE09	A2	0	1	0
DE09	A2	1	0	0
DE09	A2	1	0	0
DE09	A2	0	1	0
DE09	A2	0	1	0
DE09	A2	0	1	0
DE09	A2	0	1	0
DE09	A2	1	0	0
DE09	A2	0	1	0
DE09	A2	1	0	0
DE09	A2	1	0	0
DE09	A2	1	0	0
KA09	A2	1	0	0
KA09	A2	1	0	0
KA09	A2	1	0	0
KA09	A2	1	0	0
KA09	A2	0	1	0

KA09	A2	0	1	0
KA09	A2	1	0	0
KA09	A2	1	0	0
KA09	A2	1	0	0
KA09	A2	0	0	1
KA09	A2	1	0	0
KA09	A2	1	0	0
KA09	A2	1	0	0
PE06	A2	0	1	0
PE06	A2	1	0	0
PE06	A2	0	1	0
PE06	A2	0	1	0
AS17	A2	0	1	0
AS17	A2	0	1	0
AS17	A2	0	0	1
AS17	A2	0	1	0
AS17	A2	0	1	0
AS17	A2	0	1	0
AS17	A2	0	0	1
AS17	A2	0	1	0
AS17	A2	0	0	1
RO02	A2	0	1	0
RO02	A2	0	1	0
RO02	A2	1	0	0
RO02	A2	0	1	0
RO02	A2	0	1	0
RO02	A2	0	1	0
RO02	A2	1	0	0
RO02	A2	0	1	0
TO09	A2	0	1	0
TO09	A2	1	0	0
TO09	A2	0	1	0
TO09	A2	0	1	0
TO09	A2	0	1	0
TO09	A2	0	1	0
TO09	A2	0	1	0
TO09	A2	1	0	0
TO09	A2	0	1	0
TO09	A2	0	1	0
TO09	A2	0	1	0
TO09	A2	0	0	1
TO09	A2	0	1	0
TO09	A2	0	1	0
TO09	A2	0	1	0
SO07	A2	1	0	0
SO07	A2	1	0	0
SO07	A2	1	0	0
SO07	A2	1	0	0
SO07	A2	1	0	0
SO07	A2	1	0	0
SO07	A2	1	0	0
SO07	A2	0	1	0
SO07	A2	1	0	0
SO07	A2	0	1	0
SO07	A2	1	0	0
SO07	A2	0	1	0
SO07	A2	0	1	0
BH15	A2	0	1	0
BH15	A2	0	1	0

BH15	A2	0	0	1
BH15	A2	0	1	0
BH15	A2	1	0	0
BH15	A2	0	1	0
BH15	A2	1	0	0
BH15	A2	1	0	0
BH15	A2	1	0	0
BH15	A2	0	1	0
BH15	A2	0	1	0
BH15	A2	0	1	0
BH15	A2	1	0	0
BH15	A2	0	1	0
BH15	A2	0	1	0
BH15	A2	1	0	0
BH15	A2	1	0	0
BH15	A2	1	0	0
BH15	A2	1	0	0
CA21	A2	0	0	1
CA21	A2	0	0	1
CA21	A2	0	0	1
CA21	A2	0	1	0
CA21	A2	0	0	1
CA21	A2	0	0	1
CA21	A2	1	0	0
CA21	A2	1	0	0
CA21	A2	1	0	0
CA21	A2	0	0	1
CA21	A2	0	1	0
CA21	A2	0	1	0
CA21	A2	0	0	1
CA21	A2	0	0	1
CA21	A2	0	0	1
CA21	A2	0	0	1
CA21	A2	0	0	1
CA21	A2	1	0	0
CA21	A2	0	1	0
CA21	A2	1	0	0
CA21	A2	1	0	0
KI10	A2	0	1	0
KI10	A2	1	0	0
KI10	A2	1	0	0
KI10	A2	1	0	0
KI10	A2	1	0	0
KI10	A2	0	1	0
KI10	A2	1	0	0
KI10	A2	1	0	0
KI10	A2	1	0	0
KI10	A2	1	0	0
KI10	A2	0	1	0
KI10	A2	1	0	0
KI10	A2	1	0	0
KI10	A2	1	0	0
KI10	A2	1	0	0
KI10	A2	1	0	0
JO26	A2	0	1	0
JO26	A2	0	1	0
JO26	A2	0	1	0
JO26	A2	1	0	0
JO26	A2	1	0	0

JO26	A2	1	0	0
JO26	A2	0	1	0
JO26	A2	0	1	0
JO26	A2	0	1	0
JO26	A2	1	0	0
JO26	A2	1	0	0
KA10b	A2	0	1	0
KA10b	A2	0	1	0
KA10b	A2	0	1	0
KA10b	A2	0	1	0
KA10b	A2	1	0	0
KA10b	A2	0	1	0
KA10b	A2	1	0	0
KA10b	A2	0	1	0
KA10b	A2	0	1	0
KA10b	A2	1	0	0
KA10b	A2	0	0	1
KA10b	A2	0	0	1
DA19	A2	1	0	0
DA19	A2	1	0	0
DA19	A2	0	1	0
DA19	A2	1	0	0
DA19	A2	1	0	0
DA19	A2	0	1	0
DA19	A2	1	0	0
DA19	A2	0	1	0
DA19	A2	0	1	0
DA19	A2	1	0	0
DA19	A2	1	0	0
LI09	A2	1	0	0
LI09	A2	0	1	0
LI09	A2	1	0	0
LI09	A2	1	0	0
LI09	A2	1	0	0
LI09	A2	1	0	0
LI09	A2	0	1	0
LI09	A2	1	0	0
LI09	A2	1	0	0
LI09	A2	1	0	0
LI09	A2	0	1	0
LI09	A2	1	0	0
LI09	A2	1	0	0
CH21	A2	1	0	0
CH21	A2	1	0	0
CH21	A2	1	0	0
CH21	A2	0	1	0
CH21	A2	0	1	0
CH21	A2	1	0	0
CH21	A2	1	0	0
CH21	A2	1	0	0
CH21	A2	1	0	0
CH21	A2	0	1	0
CH21	A2	0	1	0
CH21	A2	1	0	0
CH21	A2	1	0	0
SU11A	A2	0	1	0
SU11A	A2	1	0	0
SU11A	A2	0	1	0
SU11A	A2	0	1	0

SU11A	A2	0	1	0
JO04b	A2	1	0	0
JO04b	A2	1	0	0
JO04b	A2	0	1	0
JO04b	A2	0	1	0
JO04b	A2	1	0	0
JO04b	A2	1	0	0
JO04b	A2	1	0	0
JO04b	A2	0	1	0
JO04b	A2	1	0	0
JO04b	A2	1	0	0
JO04b	A2	1	0	0
JO04b	A2	1	0	0
JO04b	A2	1	0	0
JO04b	A2	0	1	0
JO04b	A2	0	1	0
JO04b	A2	0	0	1
TE05	A2	1	0	0
TE05	A2	0	1	0
TE05	A2	0	1	0
TE05	A2	0	1	0
TE05	A2	0	1	0
TE05	A2	0	1	0
TE05	A2	0	1	0
TE05	A2	0	1	0
TE05	A2	1	0	0
TE05	A2	1	0	0